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THE JOURNAL OF THE NATIONAL DENTAL ASSOCIATION

1921

Atresia Palati—*Brophy*

Avoidance of Histo-Pathological Conditions in Bridge-Work—*Hart*

Use of the Roentgen Ray—*Thoma*

Infections of Gingivae and Treatment —*Friesell*

Three Simple Laws in Selection of Teeth —*Clapp*

The Dental Hygienist—*Stevenson*

Silver Reduction Method—*Cross*

Dentistry for More People—*Crane*

Dental Granulomas—*McConnell*

Prevention of Oral Infections—*Black*

The Problem of Focal Infection—*Conzett*

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CONTENTS

Page

Garrett Newkirk, D.D.S., 1847-1921 ..... Frontispiece

ORIGINAL COMMUNICATIONS

Atresia Palati.
By Truman W. Brophy, M.D., D.D.S., F.A.C.S. 343

The Avoidance of Histo-Pathological Conditions in Connection with Crown and Bridge-Work.
By Edward R. Hart, D.D.S. 347

The Use of the Roentgen Ray for Diagnosis of Surgical Diseases of the Mouth.
By Kurt H. Thoma, D.D.S. 354

Causes of Infections of the Gingivae and Their Treatment.
By H. E. Friesell, B.S., D.D.S., LL.D. 363

The Application of Three Simple Laws to the Selection of Teeth.
By George Wood Clapp, D.D.S. 368

The Dental Hygienist—Her Field and Limitations.
By Albert H. Stevenson, D.D.S. 372

Silver Reduction Method, Applied at Forsyth Dental Infirmary Clinics.
By Harold DeWitt Cross, D.M.D. 382

Better Dentistry for More People.
By Arthur B. Crane, D.D.S. 385

The Histo-Pathology of Dental Granulomas.
By Guthrie McConnell, M.D. 390

The Prevention of Chronic Oral Infections.
By Arthur D. Black, A.M., M.D., D.D.S., F.A.C.S. 399

The Problem of Focal Infection.
By John V. Conzett, D.D.S. 405

An Introduction to the Muscles of Mastication.
By A. LeRoy Johnson, D.D.S. 418

EDITORIAL DEPARTMENT

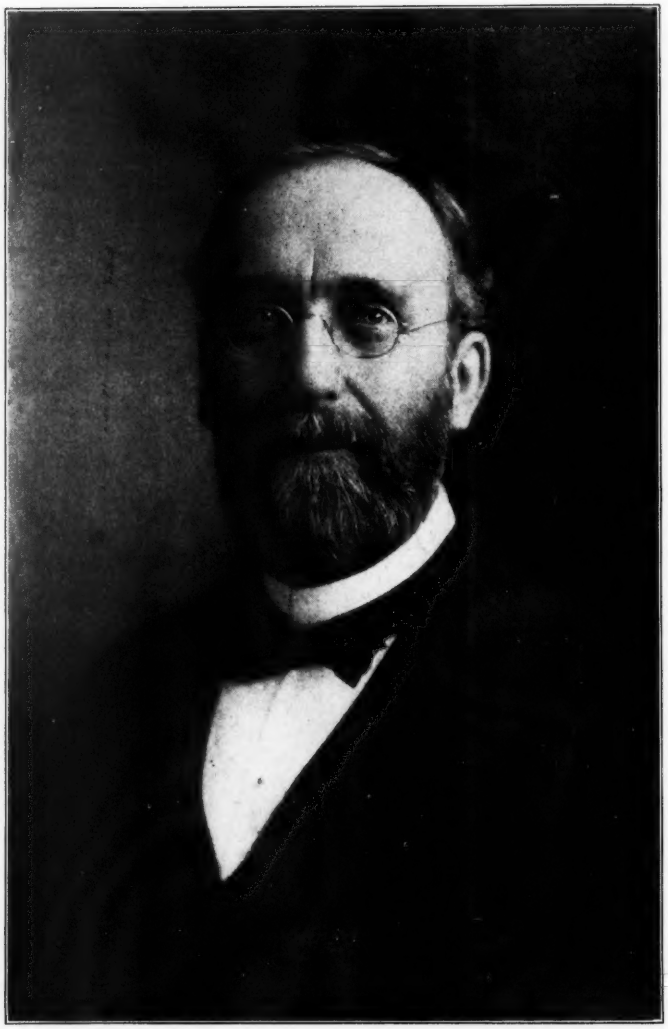
Dr. Garrett Newkirk 420
"Slaughter" of the Tonsils—and Teeth! 422

ANNOUNCEMENTS

Calendar of Meetings (National, State, Examining Boards, Study Clubs and Other Societies).—South Carolina State Dental Association.—Florida State Dental Society.—Virginia State Dental Association.—North Dakota State Dental Association.—Program of the Northern Ohio Dental Association.—Board of Dental Examiners, State of Wyoming.—Pennsylvania Board of Dental Examiners.—Tennessee Board of Dental Examiners.—National Association of Dental Examiners.—Texas State Board of Dental Examiners.—District of Columbia Board of Dental Examiners.—West Virginia State Board of Dental Examiners.—Virginia State Board of Dental Examiners.—South Carolina State Board of Dental Examiners.—Oklahoma State Board of Dental Examiners.—Southwestern Society of Orthodontists.—Dental Veterans of the World War.—Examination for Naval Dental Corps.—Arkansas State Board of Dental Examiners.—Dental Alumni Society, University of Pennsylvania.—Reserve Officers' Training Corps Camps for the Year 1921.—Dental Corps 423-428

ADVERTISING DEPARTMENT

Index to Guaranteed Advertisements A-71
Classified Section A-66, A-67



GARRETT NEWKIRK, D.D.S.
1847—1921

THE JOURNAL
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Original Communications

ATRESIA PALATI

By TRUMAN W. BROPHY, M.D., D.D.S., F.A.C.S., Chicago, Illinois

ATRESIA palati has received little attention on the part of surgical writers. The literature of the subject examined furnishes but few references to this abnormality.

Adhesions of the palate to the posterior pharyngeal wall may be the result of trauma or disease. Among the traumatic causes may be mentioned adhesions following the removal of adenoid growths and tonsils and the improper use of escharotics in treating the throat. This condition has also resulted from gunshot wounds. Any force or disease that will produce an abrasion of the membranes of the palate and throat may lead to adhesions. The diseases which affect the mucous membrane of the throat and palate, such as syphilis, diphtheria, scarlet fever, measles, etc., frequently are attended by extensive inflammation of the mouth, throat, and palate, leaving a fresh, excoriated surface which may lead to the adherence of the palate to the post-pharyngeal wall. When the palate is separated from the posterior pharyngeal wall it is certain to reunite unless some substance is introduced to prevent union until the freshened surfaces heal.

Five cases of atresia of the palate have come to me within the last four years. These sufferers found great difficulty in getting relief from their affliction. Many surgeons of great repute have declined

to operate, for reasons which it is difficult to understand. Improvement without surgical treatment is impossible.

Recently, a boy of about nine years, suffering from atresia of the palate, was directed to me. This boy's tonsils and adenoids had been removed some months previously. The freshened surfaces united, completely closing the space between the nose and pharynx. Above the point of adhesion a large pocket was formed, in which the nasal secretions accumulated and there remained, only to be drained by the patient when leaning his head forward far enough to permit the fluid to be literally poured out of the nose. A patient thus afflicted cannot blow the secretions from the nose; consequently they remain in the pocket, a source of constant annoyance and ofttimes great distress.

In this case, a physician, feeling that

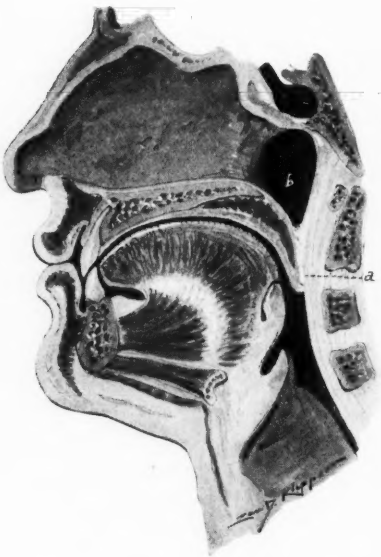


Fig. 1.—A longitudinal section of the mouth and pharynx. *A* shows adhesions of the palate to the posterior wall of the pharynx. It will be seen that the passage between the nasal cavity and the pharynx is completely occluded. *B* represents the pocket between the palate and posterior wall of the pharynx in which secretions accumulate and cannot escape except thru the anterior nares.

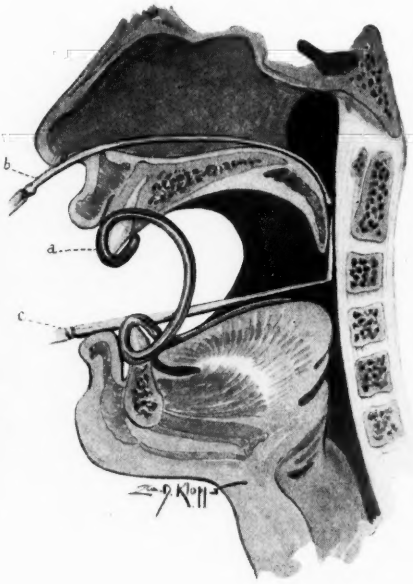


Fig. 2.—*A*, the wire oral speculum in position; *B*, the heavy silver probe, bent and introduced into the nostril, carried back to the posterior wall of the pharynx, serving as a guide in separating the palate from its adhesions; *C*, the knife employed to separate the palate from the posterior pharyngeal wall.

he should do something to establish a passage between the nose and mouth,

Fig. 3.—Wire oral speculum.

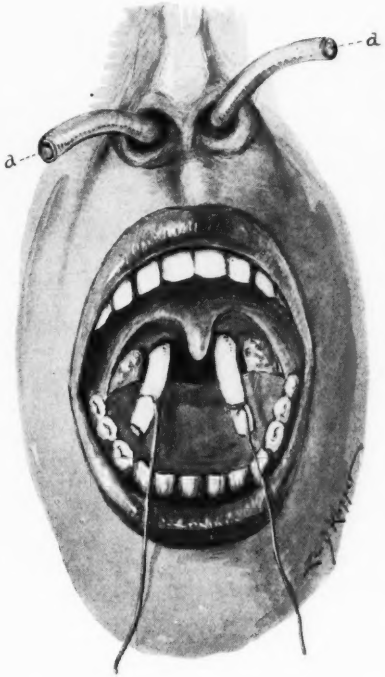


Fig. 4.—*A-A* are the catheters carrying silk sutures into position.

made a transverse incision across the palate above the point of adhesion. There was a passage thru this large opening, but the adherence of the palate to the posterior wall of the pharynx remained. The problem was to so operate as to release the adherent palate from the pharyngeal wall and to close the opening which had been made about halfway between the end of the palate

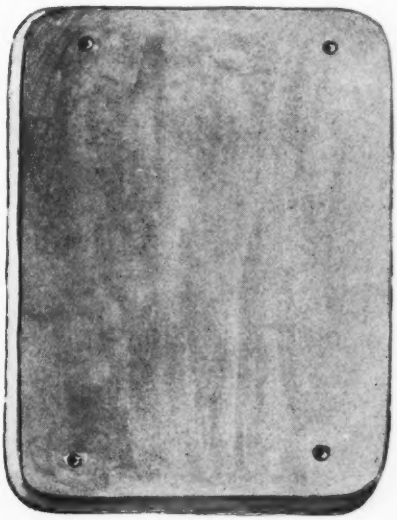


Fig. 5.—Soft rubber plate, with openings for sutures. This rubber is carried into the mouth, fastened between the freshened surfaces and allowed to remain three weeks before being removed, when the surfaces will have healed.

and the posterior border of the horizontal plates of the palate bones.

Figures 1-7 outline the technic of a course which may be followed by any oral surgeon or laryngologist with an assurance that the patient will be cured, barring only those suffering with specific disease. In these cases the tissues may not heal kindly but may, on the contrary,

break down by suppurative degeneration. A Wassermann test and all that it reveals should be taken into consideration. If the test is positive, no operation should be made but appropriate medical treatment should be instituted. After the lapse of sufficient time, with a negative Wassermann, altho not always reliable, an operation may be made with reasonable expectations of success.

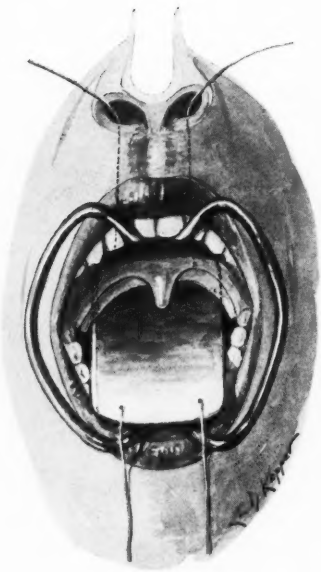


Fig. 6.—Sutures carrying rubber plate into position between the freshened surfaces.

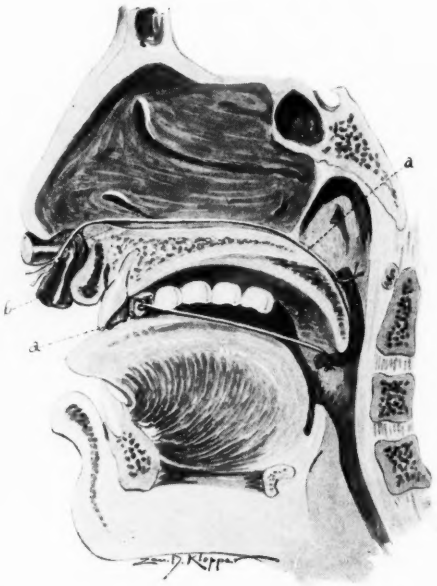


Fig. 7.—*A-A* are sutures firmly holding rubber plate in position between the freshened surfaces. *B* is a rubber glove finger stuffed with cotton, placed over the columna of the nose to protect it from abrasion by the silk sutures which hold the upper portion of the rubber plate firmly in place.

THE AVOIDANCE OF HISTO-PATHOLOGICAL CONDITIONS IN CONNECTION WITH CROWN AND BRIDGE-WORK

By EDWARD R. HART, D.D.S., St. Louis, Missouri

(Read before the National Dental Association, Boston, Massachusetts, August 23-27, 1920)

IN A SURVEY of the field of crown and bridge-work, we are astounded by the lack of thought that is being given to so important a phase as the avoidance of morbid processes which occur in connection with this branch of dentistry. But promiscuously surveying the field of crown and bridge-work by means of the X-ray and heaping condemnation upon it do not seem conducive to a solution of the problem. I will endeavor to call your attention to some of the fundamental principles that are necessary to the avoidance of these disease processes.

This phase seems to be little understood and much less appreciated, and as we observe the crowns, also the bridges, both removable and fixed types, we are surprised at the lack of appreciation of the histo-pathological consequences that may arise from the influences exerted by malocclusion, improper construction, and lack of judicious differentiation in the selection of the type of restoration for a given case. These histo-pathological consequences which may arise from the aforementioned causes are decidedly avoidable.

Both types of bridge-work, when judiciously employed and properly executed, have their proper places in the practice of dentistry. The stresses are the same in the removable as in the fixed type of bridge-work. There are the same possibilities of torsion, if constructed upon wrong mechanical principles. If insufficient care is taken in the design and construction of the abutments, a removable bridge will be just as harmful, and the consequences will be just as disastrous, as a fixed bridge improperly constructed. The sole difference between a fixed and a removable bridge is that in the fixed the union of the superstructure with the artificial supports, crowns of the various types, or inlays, is a physical union, while in the removable the union is a mechanical union provided by means of a mechanical attachment. Tooth mutilation is greater in those cases where there is an insert frictional attachment.

Fundamental prerequisites are necessary to avoid those histo-pathological conditions that are likely to occur as sequela to a lack of knowledge of the basic sciences. These sciences are: (1) mechanics, (2) anatomy, (3) histology, (4) bacteriology, (5) pathology. This knowledge of the basic sciences is also necessary in order to arrive at a correct diagnosis. For a correct diagnosis there should be: (1) a radiographic examination of the teeth and jaws; (2) digital and ocular examination of the buccal alveolar structures; (3) study models of the full upper and lower, mounted upon an anatomical articulator; (4) due consideration to the age, sex, occupation, general health, and oral hygienic condi-

tion of the patient. Let us consider each in detail.

By means of a radiographic examination, it is possible to determine whether there are disturbances of function or alteration in structure, which, in turn, might be induced by unusual agencies or conditions. The agencies or conditions which might bring about these disease processes are: (1) bone destruction, due to purulent osteitis, osteomyelitis and caries; (2) odontoma, in the form of pulp stones, hyperplasia of enamel or dentin; (3) impacted teeth, about which are found cystic formations and neoplasms, resulting in pressure atrophy and pressure toxemia; (4) roots, or portions of roots, about which are found rarefaction, resulting in the infiltration with granulation tissue of the interstitial spaces of the spongy bone and Haversian canals, and, if pyogenic cocci be present, resulting in caries of bone; (5) old necrotic sockets, resulting from the incomplete extirpation of the entire fibrous connective tissue encapsulation of previously existing granulomata within the trabeculae of the bone; (6) such conditions as the destruction of the intra-alveolar periosteum with hyperplasia of the cementum. In the aforementioned conditions a radiographic examination is indispensable.

Next we will consider the digital and ocular examinations. A digital examination is made to determine the luxation or immobility of the teeth. An ocular examination is made to determine whether there is any structural alteration of the tissues in and about the floor and vestibule of the mouth, the buccal parietes, the hard and soft palates, the tongue and tonsils, or the epithelial structures about the teeth; also the conditions of any previous restorations. The ocular examination also aids in determining whether there is any impaired function of the salivary glands, or any inhibition in the mobility of the temporomandibular joint.

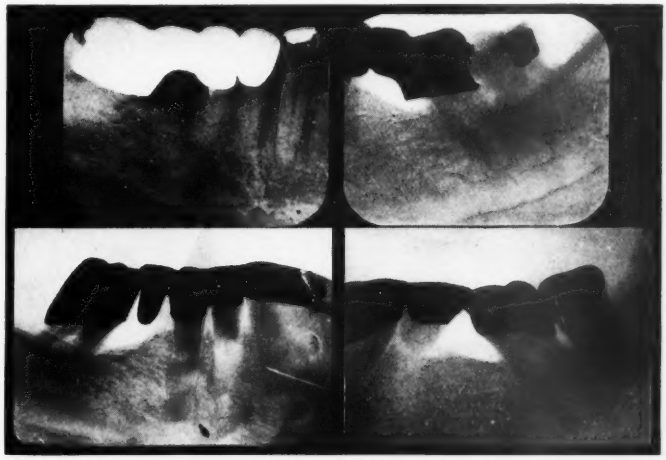
The third essential for a correct diagnosis is a study of models of the upper and lower jaws mounted upon an anatomical articulator, so that we may determine the range of articulation and occlusion, for these play a most important rôle in the health and longevity of the abutments as well as the bridge in its entirety. It is obvious, then, that our work must be built, as Dr. Monson says, "upon a geometric basis of calculation." Having determined, by close observation of the study models, the extent of occlusal abnormality, a thoro knowledge of mechanics is necessary in order to obtain ideal occlusion in our restorations, which is made possible by observing the following points: (1) All improperly constructed crowns, bridges, and fillings should be removed. (Figs. 1 and 2 show improperly constructed bridges; Figs. 3 and 4 show properly constructed restorations after being in place four years.) (2) All elongated teeth, all teeth converging or diverging, bordering on the parallel, all teeth buccally or lingually displaced, should be removed; otherwise we cannot attain the ideal. (3) Occlusal surfaces of the abutments and pontics must be anatomically and mechanically correct. A flat surface occluded with a normal, unabraded surface of an opposing tooth will not function and will cause trauma. (4) There should be no exaggeration of cusps and inclined planes, and the sulci should be well formed and not rounded. (5) The lingual and labial of the incisors and cuspids should be faithfully reproduced, and the incisal overjet and overbite must be accurately determined. (6) Marginal ridges must be properly placed and correctly formed. (7) The sulci, the sluiceways of the food under compression, as they emerge at the buccal and lingual, must be exaggerated to facilitate a more ready egress of the compressed and divided food.

The steps to consider in the construction of this ideal bridge are as follows:

(1) What constitutes an ideal tooth for a bridge abutment? (a) A tooth which is vital in every sense of the word. (b) A tooth whose surrounding and enveloping tissues are structurally normal and functionally perfect. (2) What constitutes the ideal attachment? (a) A form of attachment that involves the least number of surfaces of the tooth. (b) One that requires the least amount of destruction of tooth tissue. (c) One that least mutilates the outline form of the tooth. (d) One that can be finished with the same nicety as a gold foil filling or a gold inlay; that is, to a definite beveled joint about its periphery, so that there will be no irritation whatever. (e) One that when cast will be an accurate metallic complement to the macroscopic anatomy of the tooth prepared for the abutment. (f) One that when finished will be so rigid that it will bear the requisite load without distortion and have frictional adaptation. (g) One whose preparation can be made without injury to the tooth or trauma to the investing tissues. (Figs. 5, 6, 7, and 8 illustrate clearly these requirements.)

We have all of these requirements in the cast three-quarter crown, which should, in all justice, be called the Tinker crown, for it was Dr. E. T. Tinker who worked out and elaborated an idea received from the late Dr. Wassall, adapting the preparation to vital teeth and the casting technic. In the Tinker three-quarter cast crown we cover only from one-half to three-quarters of a vital tooth, without fear of subsequent death of the pulp. Destruction of the tooth tissue is markedly less in this form of preparation than in any other. In many areas it is not necessary to cut thru the dento-enamel junction, for we need only an offset to which to

1 2



3 4

Figs. 1-4

finish. Resistance form for overcoming lingual displacement is obtained by utilizing the natural landmarks of the tooth formed by cusps and sulci.

The outline form is so planned as to avoid disturbing the convexity of the gingival third of the buccal and lingual surfaces of the molars and bicuspids, the area which Dr. Orton has so nicely

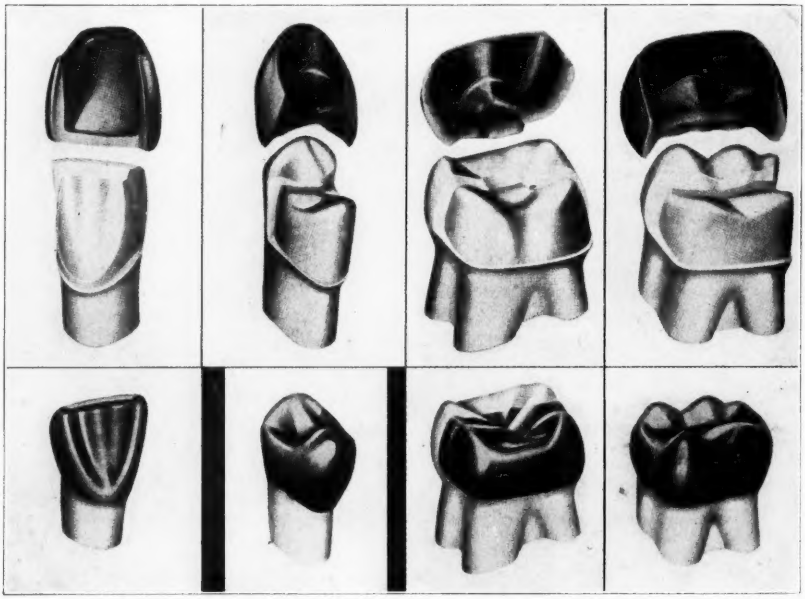


Fig. 5 Fig. 6 Fig. 7 Fig. 8

designated "the cervical marginal ridge." This ridge, when once removed, taxes the ingenuity of man in his attempt to replace it with nature's nicety.

We are of the opinion that a vast number of abutment teeth fail because an exact duplicate of the gingival contour of enamel normally covered by the free gum margin is not reproduced, thereby exposing these tissues to the effect of persistent traumatic injury. This trauma is produced by permitting food to be forced against the gum margin instead of passing over. If the occlusal surfaces of the molars and bicuspids, and the lingual surfaces of the centrals, laterals, and cuspids are not accurately reproduced, food will be forced between the teeth and into the interproximal spaces. This continuous traumatic injury finally results in an acute inflammatory exudative process, characterized by an exudation, a proliferation, and a degeneration. A separation of the gingiva as it springs from the crest of the alveolar process to surround the cervical enamel, may mark the beginning of a serious purulent process with gangrenous destruction of the Kolliker ligament, membrana propia, tunica propia, muscularis mucosa and submucosa. (Figs. 9, 10, 11, and 12 show healthy abutments.)

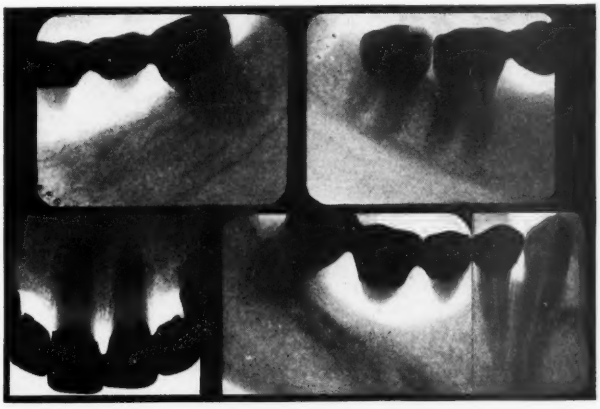
Returning to a further consideration of preparations: These can be made with a limited number of instruments

(Fig. 13). The preparations are of such nature as to obviate the necessity of removing the entire cervical enamel, avoiding the use of enamel cleavers, which so often cause much injury to the soft tissues.

After the completion of the preparation, and prior to the making of the wax pattern, the toilet of the preparation should be given consideration. The prepared teeth are carefully washed with alcohol or chloroform, dried, and all cut surfaces of the molars and second bicuspids are painted with an ammoniated nitrate of silver. The first bicuspids, centrals, laterals, and cuspids are treated with phenol, which is evaporated with hot air, immediately after which they are given a coat of thin cavity lining preparation. This toilet of the preparation we believe to be very important in the protection of those areas where the dentin has been exposed, for it closes the tubuli and protects them from becoming infected. It also protects the tooth against thermal changes.

Having observed the toilet of the preparation, the operator proceeds with the making of the wax patterns and the casting thereof, after the completion of which the abutment pieces are driven to place. Full upper and lower impressions in modeling compound, according to the Suplee core method, are taken. Plaster of Paris should never be used. These impressions, with the abutment pieces in their respective positions, are poured, and the completed casts are mounted upon an anatomical articulator.

9 10



11 12

Figs. 9-12

The next step is the selection of the type of pontics, which is dependent upon whether the teeth have been previously lost or are to be extracted and the sockets used for the reception of porcelain roots. The pontics should be so constructed as to present only porcelain in contact with the soft tissues. It is a known fact that highly fused porcelain is acceptable to the soft tissues and most hygienic. (Fig. 14 shows root before extraction; Fig. 15 shows porcelain root of pontic in place three months; Fig. 16 shows same case three years later; note filling in of cancellated bone around porcelain root.)

The possibilities of histo-pathological conditions from the use of highly fused porcelain are immeasurably lessened. In form, the pontics should be similar to

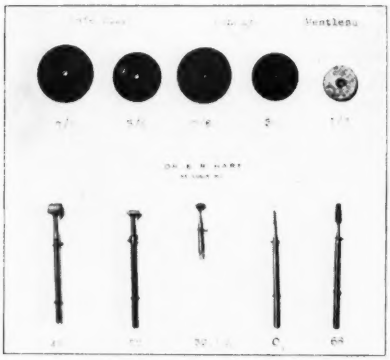


Fig. 13

the teeth which they replace, with the exception that they should be made to taper abruptly toward the gum, from the beginning of the gingival third, so there will be the least amount of surface in contact with the soft tissues. By this tapering of the pontics, the food, during the process of mastication, is forced rather violently upon the epithelial surfaces, stimulating a condition of mild hyperemia, which in this particular instance is constructive. A slight exaltation of function and sensation of the soft tissues is desired and may be obtained by the proper construction of the pontics. This is anabolic, as differentiated from that which is katabolic or destructive. The pressure of the toothbrush, the combined action of the tongue, buccal parietes, and food in its excursions along the tapering surfaces of the pontics give to the epithelial tissues a stimulation which might be favorably compared with Dr. Bier's principle of active hyperemia. By bringing this slight increase of blood to the part, the possibilities of retrogressive tissue changes and cellular metamorphosis or infiltration are lessened.

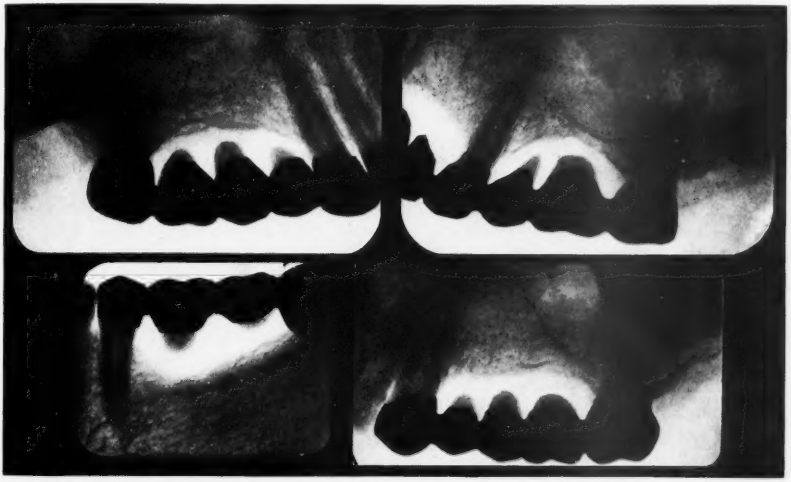
The axial surfaces, mesial, distal, buccal, and lingual, must be accurately reproduced in order to give to the pontics their proper contour, which is so advantageous in enhancing the rôle they play in mastication, enunciation, and articulation. They must preserve the normal form of the interproximal spaces, and their contact with each other, as well as with the abutment pieces, should be identical with the contact points of the natural teeth. Never should there be a closed joint from buccal to lingual or from incisal to gingival.

If all the factors previously mentioned be scrupulously observed, if every effort be exerted to a realization of a thoro understanding of the importance of the fundamental principles involved in the technic, if a comprehensive guiding conception of the fundamental sciences be continually entertained, then and only

Fig. 14 Fig. 15 Fig. 16

then will you attain the standards of highest perfection that are expected of you, in conjunction with the accomplishment of ideal crown and bridge-work. (Figs. 17, 18, 19, 20 show a few ideal cases taken at random from the practice of Dr. E. T. Tinker.)

17 18



19 20

Figs. 17-20

If I have, inadvertently, omitted giving proper credit to some one for a thought, expression or quotation, I wish at this time to acknowledge my indebtedness.

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THE USE OF THE ROENTGEN RAY FOR DIAGNOSIS OF SURGICAL DISEASES OF THE MOUTH

By KURT H. THOMA, D.D.S., Boston, Massachusetts

(Read before the National Dental Association, Boston, Massachusetts, August 23-27, 1920)

EXTENSIVE lesions of the mouth are not easily recognized, and the Roentgen method is one of the most important means of making an early and correct diagnosis. It has been my experience that cases of extensive bone infection or large cysts are generally not recognized for a long time, and devitalized teeth associated with them are often treated for months by means of root-canal medication before a correct diagnosis is made. While clinical evidence and examination should not be neglected, it is indisputable that a good Roentgen picture gives the greatest amount of information. Not only does the roentgenogram indicate the location of the lesion and its size and extension, but the finer points seen in a good picture are often valuable in making a differential diagnosis. As time goes on, it will no doubt be possible to further improve the technic so that still finer changes can be demonstrated in a Roentgen negative, while systematic research work and comparison of Roentgen findings with the result of pathological examination and operative findings will so increase our knowledge that the Roentgen method will become a more and more valuable means of examination. I shall confine my paper to three diseases of the maxillary bones which are most frequently met with in the practice of dentistry, namely, osteitis, osteomyelitis, and cysts.

Osteitis of the Jaws

Osteitis of the maxillary bones is in by far the largest percentage of cases due to an infection originating from a tooth. The acute suppurative type, so-called acute alveolar abscess, may cause extensive bone destruction in a short time; the cavity so formed is then filled with pus, and in the Roentgen picture it appears as a cloudy dark area of large dimensions. Very often, however, an acute abscess, altho well marked by clinical symptoms with extensive swelling and severe pain, will reproduce no picture on the Roentgen film. This may be due to the fact that the root apex is so near the outer or inner alveolar plate that the pus finds at once an outlet to the surface by way of the Haversian canals, accumulating under the periosteum, the bone itself being involved to only a very slight extent.

In chronic osteitis, inflammatory granulation tissue replaces the bone; therefore it is also called granulating osteitis. It may include large portions of the jaw without causing pain or any other symptoms. A blind abscess or dental granuloma represents a granulating osteitis in a small way, and it is only on account of the wonderful resisting power of the bone of the jaws and the liberal blood supply that extensive granulating osteitis is not a very common affection. Bone destruction, however, is usually more ex-

tensive than we generally believe, as evidenced by the process of osteoporosis seen in Figure 1 on the buccal surface over the roots of the first maxillary molar. Figure 2 shows another skull with evidence of a granulating osteitis.

Fig. 1

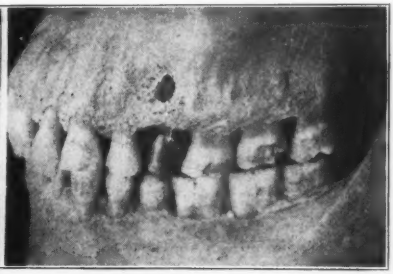

Fig. 2

In this case part of the alveolar plate has been destroyed but the condition is still one which may be classified as caused by a dental granuloma which never may grow any larger. Sometimes,

Fig. 3

however, the process of rarefaction continues and a more extensive cavity results. Figure 3 shows a skull with a typical granulating osteitis in the upper and lower jaws. The disease, which evidently started from pulp infection, has destroyed a large amount of the bone. In a Roentgen picture the loss of bone, causing a radiolucent condition, would show as a dark area. In case of a dental granuloma, as that which caused the abscess cavity in Figure 2, it would appear of small size, as shown in the roentgenogram (Fig. 4). Granulating osteitis of more extensive type would be indicated by a larger area, usually of irregular outline with very indistinct margins, due to a gradual change from healthy to diseased tissue. Such a case is shown in Figure 5. Patient Mr. W. C. B. showed, on examination, tenderness on the gum over the lateral incisor; no other history. The Roentgen picture revealed a large area of dark appearance with an indefinite outline, into which protruded the root of the lateral incisor. The cavity was found to be filled with granulation tissue and pus, the surrounding bone being of a spongy character. Figure 6 shows the case of Mr. I. M. B., who had at times a slight swelling on the gum over the lateral incisor which discharged a slight amount of pus and then disappeared. Roentgen examination showed a dark area of irregular shape and indefinite outline, with root apex partly absorbed. A Roentgen diagnosis of granulating osteitis was made, and pathological examination showed that

the inflammatory granulation tissue contained colonies of the fungus actinomyces, as shown in Figure 7.

DIFFUSE OSTEOMYELITIS OF THE JAWS

Fortunately, the infections from teeth nearly always remain localized; when, however, spreading takes place along the marrow spaces inside the bone, it usually attacks the entire jaw and presents a very serious condition, spoken of as diffuse osteomyelitis of the jaws. In the early stage we find a rarefied condition extending over a large portion of the jaw; the marrow spaces which show dark in the Roentgen picture become enlarged, as clearly seen in Figure 8, below the lateral, cuspid, and first bicuspid. Later, channels are formed which extend along the bone and give it in the picture an appearance of worm-eaten wood. Pieces of bone which become cut off from nutrition become necrosed, and in advanced cases sequestra are formed. These can be seen as pieces of bone entirely surrounded by a dull shadow. New sequestra are frequently formed during the healing process, causing more or less disturbance and discomfort. They can be located by means of a new Roentgen picture, as seen in Figure 10. In neglected cases the bone may become weakened to a dangerous point. In one case spontaneous fracture occurred in the molar region of the mandible before the patient presented for treatment. The jaw was fractured at night while he was lying on the affected side of the face.

Fig. 4 Fig. 5 Fig. 6

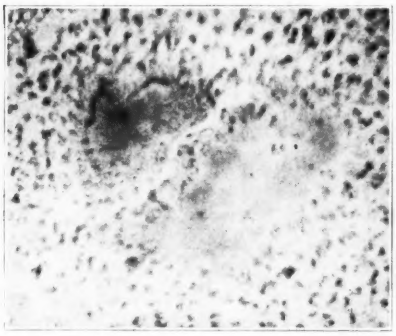

Fig. 7

A typical case of osteomyelitis of the mandible started after a tooth (the lower first molar) was capped by a dentist. Two days later it was extracted because it had become abscessed. The condition grew worse and the patient went to a hospital, where she received palliative treatment. After two weeks she complained of pain in the entire lower jaw,

inability to open her mouth, and soreness of the teeth. The Roentgen plates taken at this time showed a rarefied condition extending from the bicuspid region on one side to the other (Fig. 8). Altho surgical treatment was started at once, the disease spread as far as the angle of the opposite jaw (Fig. 9). Later on, when the patient was well on the way to recovery, small sequestra become evident from time to time and could be located by the Roentgen method (Fig. 10). At the angle of the jaw a sequestrum is seen surrounded by a dark area, which indicated the inflammatory process connected with it.

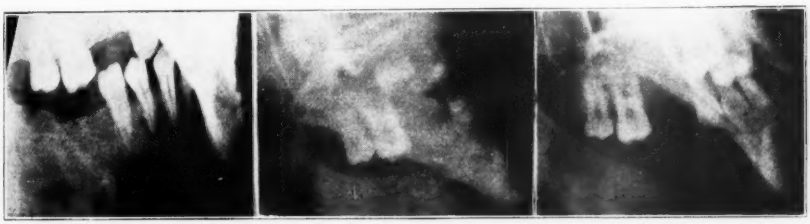

Fig. 8 Fig. 9 Fig. 10

Fig. 11

Figure 11 shows a case of advanced osteomyelitis of the upper jaw in a girl nineteen years of age. She had two teeth extracted and replaced by a bridge, but her mouth had been sore for eight months afterward. The bridge was then removed and the gums lanced without giving relief. The roentgenogram taken shows a typical case of osteomyelitis with bone necrosis.

Another case of osteomyelitis of the mandible is that of a man who had suffered for over four weeks of pain in the right side of the lower jaw. A gum boil formed, and the first dentist who was consulted extracted the left lower first molar. As the pain did not subside he had the next tooth extracted. The swelling and pain increased; the dentist who had treated him thought it would be better in a few days. A physician and another dentist saw him, the latter of whom finally extracted the treated tooth and one other in front of it, which was loose. After two weeks two more teeth were removed, and later on he had the gum lanced. When first seen the patient had a temperature of 100°F. A great deal of pus discharged continuously from the gum. Cuspid, bicuspid, and two molars were missing; the third molar was firm; the incisors tender and loose. An inflammatory condition of the gum with many fistulae was apparent. Roentgen pictures were taken at once. One of them is shown in Figure 12. It shows many sequestra surrounded by

dark areas, indicating an inflammatory condition all thru the jaw.

Cysts of the Jaws

Cysts are of comparatively frequent occurrence in both the upper and lower jaws, but they usually escape notice until they have attained large proportions. We distinguish two types of cysts. The follicular cysts originate from the dental follicle and are frequently found in the early part of life. The radicular cysts result from a blind abscess or granuloma on the root of a tooth, and thus get their name.

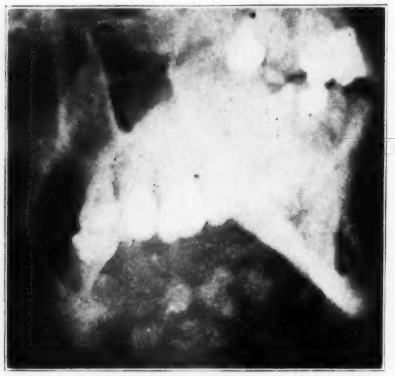

Fig. 12

Fig. 13

All cysts, on account of their encroachment on the bone, are radiolucent and give a dark-appearing picture. This is usually of irregular outline, with a light and distinct line surrounding it. This light line indicates cortical bone which is formed around the cyst sack, probably as a protective measure, and it is important to differentiate a cyst from other bone lesions. Very typical Roentgen pictures of cysts are shown in Figures 17 and 20. Roentgen diagnosis is also of value to give the relation of the cyst to important neighboring structures, such as the inferior alveolar nerve, the maxillary sinus, and the nose. It will show the number of teeth involved, and is a valuable guide for the operative technic.

Follicular cysts.—They are caused by abnormal development of tooth follicle during the developmental stage of the teeth. They may contain a misplaced, unerupted, or supernumerary tooth, and are called *dentigerous cysts.*

The Roentgen picture of W. W., a boy, nine years old, is shown in Figure 13. His mother noticed a swelling in the cuspid region on the right side of the upper jaw, and thought that it was the cuspid about to erupt. When the temporary molars started to become sore they were treated by his dentist and finally fell out. The condition, however, was not relieved. The Roentgen picture revealed a dark area with clear definite outline, containing an unerupted cuspid. Diagnosis of dentigerous cyst was made, and when operated upon the tooth was found located in the nasal wall.

Another case is that of a man about sixty-five years old. A sinus in the wisdom-tooth region emitted a discharge with offensive odor. The roentgenogram shows a large area of uniform dark ap-

pearance, with a distinct white line surrounding it, and a misplaced tooth at the angle of the lower jaw.

Besides one or two well-formed teeth, a follicular cyst may contain rudimentary tooth particles. These may be composed of enamel, dentin, cement, dental pulp, and sometimes bone. An irregular mass of tooth gum from which these tissues have been formed is also

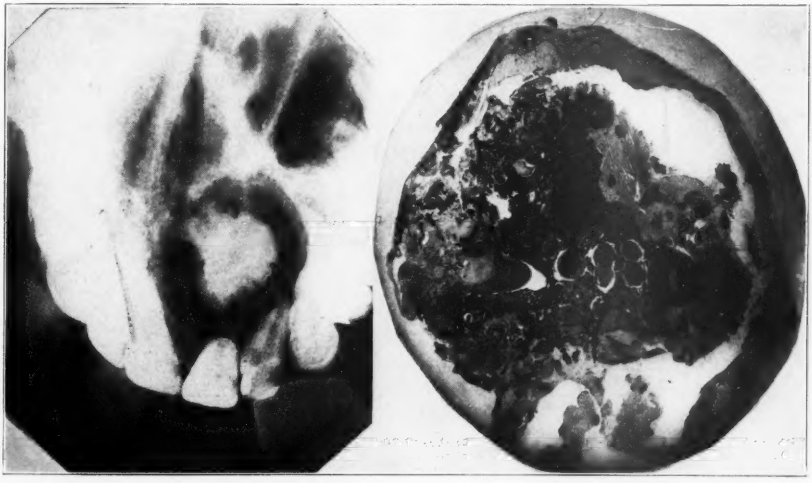

Fig. 14a

Fig. 14b

often noticeable in a microscopic preparation. Such a lesion is spoken of as a *cystic odontoma.* If enamel organs with ameloblasts laying down enamel only are found, we speak of it as a *cystic adamantonoma.* In the Roentgen picture the cyst is seen to contain an irregular calcified foreign body sometimes more or less resembling a fused number of teeth.

The case of R. W., a boy sixteen years old, presented the following history: For several months he noticed a swelling under his upper lip; the left central and lateral became tender, and the dentist he consulted removed the pulp of the lateral and treated the tooth. Whenever the dressing was removed from the root-canal, a yellowish fluid escaped thru the tooth. As the condition did not get better, he lanced the gum several times, without beneficial result. A Roentgen picture which was taken (Fig. 14*a*) at once revealed a large dark area surrounded by a distinct light line. The incisors appeared to be pressed to the side, and a radiopaque mass of tissue appeared to be located in its center. There was no tooth missing. A diagnosis of cystic odontoma was made, and the operation as well as the pathological findings confirmed the diagnosis (Fig. 14*b*).

The radicular cyst is of inflammatory infectious origin and is developed from a blind abscess or dental granuloma if it contains remnants of epithelium from the enamel organ. If these are stimulated thru the irritating influences of chronic inflammation, they proliferate

thruout the lesion, forming an entire lining of the abscess cavity. Accumulation of exudates with broken-down tissue causes extension of the cyst, which may grow to tremendous size. The bone may become so thin that a crackling sound can be heard on palpation. In many cases, however, there are no actual symptoms, and the only means of diagnosis is by the Roentgen method. Radicular cysts start usually from one tooth but may involve a larger number when expanding. In the upper jaw they quite often encroach on the nasal cavity or grow into the maxillary sinus. Anteroposterior Roentgen views, as well as side views of the entire face, are necessary, and sometimes it is quite difficult to make a positive diagnosis.

Sometimes a true radicular cyst is found without being connected with a tooth. In such a case there is usually a tooth missing. This tooth may have been extracted with the cyst but not diagnosed, or else a granuloma may have been left in the jaw after the tooth was removed, from which the cyst developed later.

Figure 15 shows a Roentgen picture of an upper incisor with a bridge abutment, with good root-canal filling. The socket where the central had been extracted is still visible. A dark area is seen, into which the apex of the lateral protrudes, but it apparently is also connected with the socket of the extracted tooth. A distinct light line is seen around the area, which is the picture of a small cyst.

Miss C. F. M. had a swelling on the gum eight years ago; this had been opened and scraped. The condition improved somewhat, but after two or three years a sinus formed, and more or less pus-like fluid had escaped ever since.

Fig. 15 Fig. 16 Fig. 17

Roentgen examination (Fig. 16) revealed a very large dark area with a light line surrounding it. It was apparently the picture of a radicular cyst caused by a blind abscess on the right upper lateral incisor, a tooth which had been treated and filled. Operative findings showed that the bone cavity indicated in the picture had a very solid cortical wall of healthy appearance, which is the usual condition of the bone in a cyst and is directly opposite to the condition of the bone in granulating osteitis.

Mr. G. H. H. presented a case with swelling on the gum in the upper jaw. A Roentgen picture (Fig. 17) shows a typical cyst including two incisors. These teeth the patient states had been

devitalized eight years ago but he had noticed the swelling for only seven months. An opening had formed two weeks before, discharging a fluid containing pus.

A Roentgen picture of a case in which three teeth are involved is shown in Figure 18. In this case the cyst caused considerable bulging of the facial surface of the maxilla, but the patient had no discomfort until very recently, when such a violent inflammation set in that his eye was closed completely. He received palliative treatment but no attempt was made to make a diagnosis. When first seen a sinus had formed to the face, and the Roentgen examination revealed a very large radicular cyst with suppuration due to secondary infection.

Figure 19 shows another roentgenogram of a small cyst in the lower jaw which still has about the dimensions of a good-sized granuloma. It is around the apex of a second bicuspid, the pulp of which probably has become infected from decay which shows underneath the filling.

A case of a large cyst in the mandible is that of Mr. J. T. G. He complained of a tender spot on the outside of the face, especially noticeable when shaving. Roentgen examination (Fig. 20) showed a large dark area with well-defined outline and three teeth involved. It extended almost to the inferior border of the mandible, and right beneath the apex of the first bicuspid appeared another dark spot about the size of a large pea. The large area is, of course, a typical picture of a cyst, while the small area, which was still darker, represented, as revealed during the operation, a perforation thru the outer plate of the bone. It was this spot which felt tender.

The roentgenogram shown in Figure 21 contains a picture of a cyst which apparently is not connected with a tooth. However, there are two teeth missing which have been replaced by a bridge. The two bridge abutments are perfectly normal teeth with vital pulp. According to the history, the two missing molars had been extracted a long time ago, but an inflammatory condition reappeared several times. On examination, the

Fig. 18

Fig. 19

bridge was found to be imbedded in hypertrophied gum; a pus-like fluid could be pressed out from a sinus where her dentist had made an incision. The operative findings confirmed the diagnosis of an infected radicular cyst.

A case where a radicular cyst extended into the antrum is shown in Figure 22. Miss A. H. P. had a great many abscessed molars in the upper jaw. An anterior-posterior Roentgen picture of

the head was taken, which showed that a radiopaque condition existed in the left maxillary sinus, indicating maxillary sinusitis, while on the right side the picture showed a radiopaque condition of the lower two-thirds of the sinus with a distinct convex border separating it from the upper part, shown as a triangle of dark appearance. This led to the diagnosis of radicular cyst, and on operating it was found that a regular cyst had formed inside the maxillary sinus without outlet into the nose and separated from the normal part by a complete bony wall.

Fig. 20

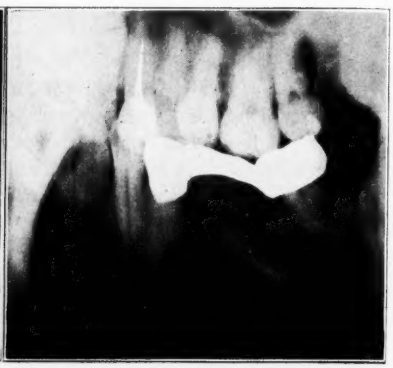

Fig. 21

From the pictures shown in connection with the case reports, it is evident that small dental films are but in very rare cases sufficient for this work. Their use often leads to a false diagnosis. Extra-oral plates and of the largest size, and intra-oral films (especially useful in the upper jaw) should alone be relied upon in connection with this work. Often it is advisable to get pictures from different angles, or, better still, stereoscopic pictures. Neither the roentgenologist nor the dentist should be satisfied with a roentgenogram just good enough to make a diagnosis from; the picture must show the entire lesion and its relation to the surrounding structures, because such a picture alone is of value to the oral surgeon who later on is called upon to perform the operation.

Fig. 22

CAUSES OF INFECTIONS OF THE GINGIVAE AND THEIR TREATMENT

By H. E. FRIESELL, B.S., D.D.S., LL.D., Pittsburgh, Pennsylvania

(Read before the National Dental Association, Boston, Massachusetts, August 23-27, 1920)

DENTISTRY which has been engaged mainly in surgical and restorative measures in which it has made the highest progress is now entering upon an era of preventive dentistry. Our inability to cope with the problems of tooth restoration and replacement, the hopelessness of that task on a quantitative basis, and the recognition of the serious systemic results of infected mouths have compelled us to direct our attack on dental disease at its source, for we must realize that the hope of success in dentistry lies in prevention and not in cure.

The most usual portal of entry of infection into the blood stream thru the mouth is undoubtedly thru the peridental membrane, and inasmuch as the usefulness and preservation of the tooth also depend upon the maintenance of a healthy peridental membrane, the prevention of disease in this organ assumes paramount importance.

Nature makes provision for this protection by means of a special arrangement of the gum tissues, to a portion of which we give the term gingiva, or gingivae. All of that portion of the gum tissue which lies to the occlusal of the crest of the alveolar process is called the gingivae. It covers the occlusal border of the process, the neck of the tooth, fills the septal space, and overlaps the gingival area of the crown of the tooth in such manner as to protect much of the enamel surface from decay that is not kept scoured and polished by the food during mastication.

The peridental membrane, once exposed to the secretions of the mouth and in direct access to the bacteria thereof, readily becomes infected, which infection is practically hopeless of cure and extremely difficult of control. The gingiva, however, composed of gum tissue and covered by mucous membrane, possesses most remarkable powers of recuperation and of resisting infection. So long as the gingivae remain in a normal healthy state they afford perfect protection to the peridental membranes against infection or disease beginning at the gingival border, and since that point is the most vulnerable and most frequent focus of infection in the mouth it becomes our first duty to maintain the gingivae in sound health. While the gingivae are so highly resistant to injury and infection, it also should be recognized that they are subjected to unusual exposure by injury in mastication, owing to their position in the mouth.

Under normal conditions the form of the crown of the tooth, as a result of its various contours, and especially the

height of contour on the axial surfaces, is such that during mastication the food passes from the tooth surface and strikes the tooth—whether it be due to wear, decay, unskilful restoration, or other cause—which results in directing the

Fig. 1. Lack of contact of proximal fillings

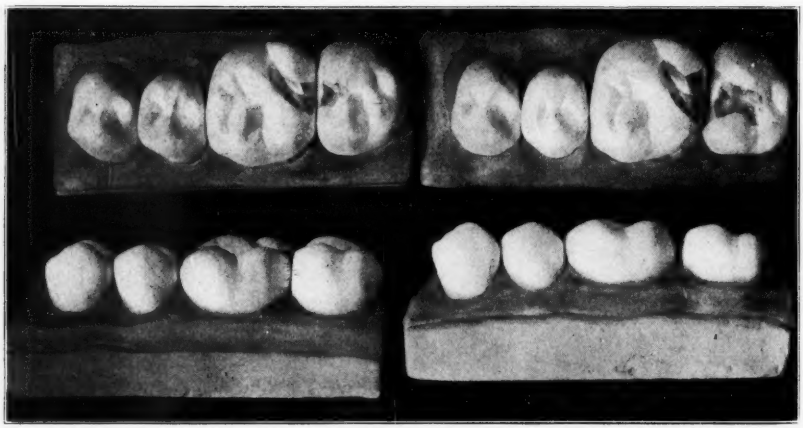

Fig. 2. Broad, flat contact of proximal fillings

the gingiva at the tangent, passing over its surface and affording it normal use and stimulation. But if there be any deviation from the desirable contour of food against the gingiva in such manner as to produce repeated injury, inflammation and infection eventually result, notwithstanding the remarkable vitality and

resisting powers of this tissue. So close is the connection between the gingiva and the peridental membrane that serious tachment of the gingiva to the peridental membrane at the gingival line results in a relaxation of the fibers that hold the

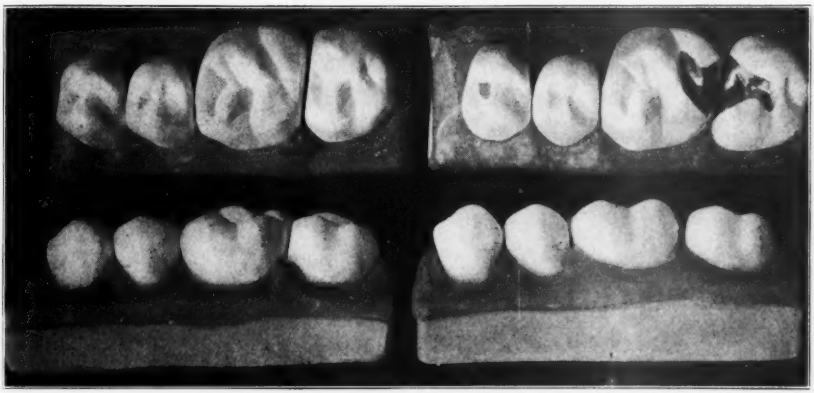

Fig 3. Worn contacts

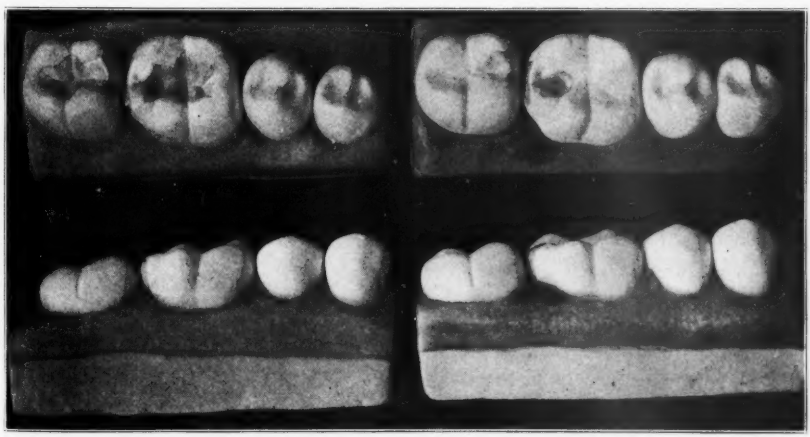

Fig. 4. Weak contacts

injury to the former ultimately results in disease of the latter tissue, with the serious sequelae familiar to all.

Interference of any kind with the at- gingiva snugly against the gingival margin of enamel, enlarges the subgingival space, permits the collection and disintegration of food in the space,

with consequent exposure of gingiva and peridental membrane to infection therefrom, and permits an extension of the gingiva beyond the contour lines of that tissue. These lines normally harmonize with those of the tooth crown, and in this way also makes impingement of the food possible upon the gingiva, with the results already stated.

Since physical injury of the gingiva precedes its infection and disease in practically all cases, it would be well to consider some of the most common causes thereof.

A more careful study of tooth form with special reference to the gingival line and the height of contour, as well as the contact form and position of the gingivae, and a recognition of the importance of a harmonious interrelationship between the contour lines of tooth surface and gingiva, will accomplish great good in preventive dentistry and the control of oral focal infection.

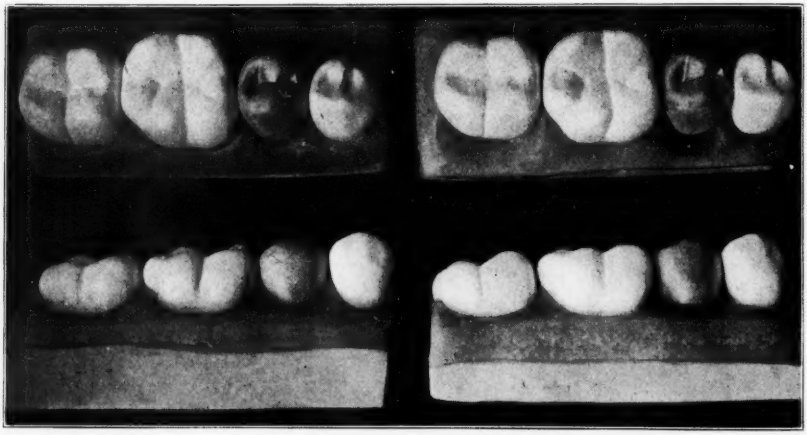

Fig. 5. Poorly contoured crowns

Discussion

J. D. Whiteman, Mercer, Pennsylvania: A shockingly large percentage of the causes of this condition is due to poor dentistry.

Obviously, when a patient brings a child for dental attention it is for the purpose of saving the child's teeth. That we consider only an examination for decay or perhaps a prophylactic treatment is merely because we have been taught that these are the only essentials to that end. We know that malocclusion will ultimately and inevitably result in gingivitis; that gingivitis will just as surely result in pyorrhea; that pyorrhea, existing under these conditions, is practically incurable, inasmuch as the cause cannot then be removed; and yet unless malocclusion in the child is sufficient to produce disfigurement it will be allowed to go neglected, only because we have fallen short of our duty to enlighten the parent as to the serious consequences that follow that condition.

A little inflammation of the gums is in itself but an insignificant thing and not at all alarming to the patient; yet, as the essayist has pointed out, the prevention of this apparently insignificant inflammation is really of paramount importance.

It is evident that gingivitis is to be regarded as a progressive, destructive yet fortunately a preventable disease, and that the solution of the pyorrhea problem, lies, not in the treatment of the disease, but in the recognition and correction of the conditions favorable to its development. I do not wish to be understood as holding inefficient dental service entirely responsible for the existence of gingivitis, for

we all know that neglected oral hygiene on the part of the patient is responsible for its full share.

It is important that we teach our patients that in a large sense we as dentists cannot save teeth, but can only put them in a condition so that they can save them.

Charles E. Woodbury, Council Bluffs, Iowa: We in the Middle West see many cases of gingivitis that have been caused by dental errors. The reason that we are chargeable with these errors is because of the fact that we do not study our cases before operating. We are good mechanics but poor pathologists. When a case presents itself much time should be spent on the study of that individual case. We should view it from all angles and decide what is necessary before anything is done. In that way we will correct many of the errors with which the dental profession has rightly been charged.

The average person is not aware of the extent of the interproximal wear that comes from the sliding of the teeth, one against the other. This wear from the distal surface of the third molar on one side of the arch to the distal surface of the third molar on the opposite side of the arch averages, at the age of thirty-five, as much as one centimeter, almost half an inch. When a case presents itself to us for an operation, separation should always be made, no matter whether the decay has been sufficient to involve the contact or not, because there is always a loss of the interproximal space. The teeth should be forced apart so that we can compensate for the wear that is ever present after that age.

The third molars have seemed to be a superfluity, and it is often said that those teeth are of no benefit. In the study of the anatomy of the jaws it seems that the third molars—I do not refer to impacted third molars, or third molars out of alignment—that come in a natural way should stay. They are the most important teeth in the whole arch. They have a special duty to perform aside from mastication. The teeth as they erupt in the jaw move in three dimensions of space. They move forward, outward, and downward, and in the case of the lower jaw, forward, outward, and upward. The especial function of the lower third molars is to keep the contacts. The end of the root is set in a deep hard structure of bone; it is not set in the alveolar process. As it grows forward, it moves all of the lower teeth forward and keeps the contacts tight; thus, as this interproximal wear takes place at the contacts, the third molar is the adjusting screw, the jack screw that holds all of these teeth in tight contact. It also influences the teeth in the upper jaw.

Occasionally cases come to us with the membrane involved from long loss of contact. We are justified in cutting cavities in these teeth, if they are not present, and making gold inlays which carry a spur of filling material from the occlusal surface of one tooth to the occlusal surface of the other tooth, thus making teeth serviceable.

Success of every dental operation is in attention to detail. There is no short cut to excellence in dentistry. We must be thoro. We must study our cases. And when we make an operation, we must make it complete to its last exact detail.

Dr. Friesell (closing): I feel that it is necessary for dentists in general to get back to fundamental principles and understand that the mechanical operation, no matter how perfect it may be mechanically, must also be made in accord with a knowledge of the conditions that govern tooth form and tooth function.

THE APPLICATION OF THREE SIMPLE LAWS TO THE SELECTION OF TEETH

By GEORGE WOOD CLAPP, D.D.S., New York City

(Read before the National Society of Denture Prosthetists, Boston, Massachusetts, August 20, 1920.)

THE application of the laws of harmony, as found in art, to the choice of artificial teeth results in the most artistic selection possible. It prevents monotony in tooth form. Any infraction of these laws produces disharmony and reduces the artistic value of the restoration.

What is art? For our purpose the definition might read that it is the production, by human means, of significant forms, that is, forms that have definite meaning. Many forms are insignificant because they do not express ideas, they do not arouse ideas in others. The production of such forms may be manufactured, but it is not art.

The best definition of good art declares that art to be good which the people best informed about art believe to be good. The opinion about art changes with the advance of knowledge, so that what was good art years ago is not necessarily good art today. And it follows naturally that people who have not taken pains to inform themselves regarding art may very easily think something to be good art which is quite the reverse. Thus, a dentist who has not been well instructed may admire natural dentures which are far below the finest of nature's achievements, merely because he does not know how to recognize fineness of achievement. If he seeks to reproduce the dentures he thus unknowingly admires, he does far less than he could with more knowledge.

The difference between art and nature should be understood. Nature produces forms in a plan which may be too big for us to perceive. According to the time and place, some of these forms are significant and others are insignificant. Occasionally we find a small area of her creation in which only significant forms are present and we say that such an area is artistic.

But art is man-made. Man has found that certain forms signify to him certain perceptions and ideas. When he wishes to express those ideas to others, he finds that if he takes a little space out of nature or life and puts these forms into it, they will signify to others what they caused him to feel and think. The selection and production of forms from nature to express certain ideas or feelings is art.

The production of forms to express an idea of feeling is greatly facilitated by the observation of rules which have grown up as the result of practice and teaching. Three of these rules are so nearly self-evident that we can easily master them, and they are so essential to artistic prosthesis that unless we do master them our results will be very imper-

fect. The rules are as follows: (1) in any one composition there can be only one dominant theme; (2) there must be sufficient diversity of details to avoid monotony; (3) the introduction of a second theme produces disharmony.

It may be well to recognize that nature produces disharmonies of form and color everywhere and that disharmonies are deliberately used by man in certain forms of expression to heighten the effect of harmonies.

Nature struggles against innumerable handicaps. When man helps to reduce the number of those handicaps, as in providing favorable conditions for the production of flowers and fruit, nature reaches rapidly toward perfection and the average of her achievements is immeasurably greater than under ordinary circumstances.

Man uses disharmonies to heighten harmonies, but only in transient things. Pickles or olives may be used on a table to prevent the taste becoming jaded by similarity of courses, but the pleasure is complete when the sharp taste of the pickle is lost in the taste of the succeeding course. Few persons would care to close a meal with the pickle taste dominant.

Discords are deliberately used in music to heighten the effect of the following harmony. They can be properly introduced only by a master-hand and are never allowed to take control of the composition. It is essential that every discord in music shall resolve itself into the harmony and be lost therein. A fine piece of music never ends in a discord.

There is a very real distinction between the discord in a transient thing, like a sound or a taste, which quickly passes, and a disharmony in a permanent thing, like a painting, a statue, or a denture. Great artists, in creating permanent things, never allow disharmonies. Nature does not permit disharmony in physiology. A disharmony in physiology is pathology and the end thereof may be death.

Let us now come back to our three laws, that any composition must express one theme, that the details must express what the artists call "diversity in unity," and that the introduction and emphasis of a second theme results in disharmony and artistic destruction.

Let us recognize that the teeth are a detail of the facial expression, important and capable of sub-division among themselves, but not the all-important factor in facial appearance, tho they are easily capable of spoiling that appearance.

The face itself is the important factor in facial appearance. It sets the theme or keynote. That keynote is set by the proportions of the face and by the lines bounding the features. Each patient comes to us with his theme set. Our task is to read it aright, to harmonize the teeth with it as a detail, to avoid marring the theme by monotony of tooth form, and not to spoil it by an effort to introduce a different theme.

Prior to 1914, it was not possible to do any of these things scientifically. A few highly gifted dentists, working along wrong lines, but being partly right by their art sense, produced pleasing results. In the light of present knowledge those results may be surpassed.

In 1914, Dr. Williams contributed the only scientific law of harmony between face forms and tooth forms. Taking nature's finest achievements as a standard, he showed that the natural upper central incisors are of the same proportions and form as the face in too many instances and in too many unlike forms for the resemblance to be the result of accident. He showed, also, that the more the tooth form was unlike the face form, the less pleasing were the dentures, and that the only really displeasing dentures, as far as tooth form is concerned, were those in which the teeth were noticeably unlike the face form.

The studies which produced the law

of harmony showed how it could be applied. They included the discovery of the typal forms in teeth and the recognition of similar forms in faces. They showed that all normal human faces are harmonious with one or more of about a dozen blendings of the typal forms; and that one or more of about a dozen blendings of typal forms in teeth would be harmonious with any normal face. So much, then, for the first law which said that in any composition one theme must be dominant. The face is the dominant

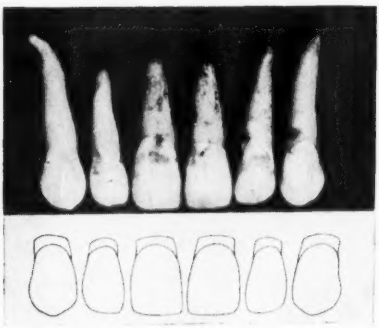

Fig. 1

element in facial expression; the teeth are details and are subordinate. The form of the face sets the theme and the teeth must harmonize with it. Our task is to select teeth in which the centrals are of the same proportion and form as the face, when seen full front, in repose.

The second law said that the details of the composition must present sufficient diversity to prevent monotony. We need not fear that the selection of centrals of the same proportions and form as the face will produce monotony because the tooth form is inverted, as compared with the face form. This inversion, which artists call "opposition of line," is essential to artistic composition. It is found everywhere. Good paintings, sculpture, or photographs cannot be produced without it.

The necessary diversity of detail in the forms of the teeth is pleasingly effected by the characteristic forms of the upper laterals and cuspids. Tapering laterals and cuspids fall within the limits of the tapering type, but they are not like square centrals. They present "diversity in unity" (Figs. 1-3). It is entirely unnecessary to go outside the limits of the type shown by the centrals to find lateral and cuspid forms which offer all the variety consistent with harmony.

For half a century or more we had only conventional forms of artificial anterior teeth. The upper laterals were merely narrow centrals. The cuspids differed principally in the form of the incisal edges. The similarity of outline and surfaces in these teeth produced monotony. To get away from this, many dentists broke the monotony by selecting from several sets for a single denture, or reconstructed the forms by grinding. According to the knowledge of the day, they did well.

In our efforts to escape monotony, some of us swung to the other extreme. We begun to regard diversity in tooth form as an end in itself. Knowing no law of harmony, we felt that the greater the diversity, the greater the artistic value, and some of that feeling remains to this day. Now that we have a law of harmony between faces and teeth and a knowledge of types and their combinations in tooth form, we are no longer justified in admiring and imitating anything which is less than nature's best.

Our third law is that the introduction of a second theme into a composition produces disharmony and reduces the artistic value of that composition.

We see such disharmonies of face form and tooth form daily. Sometimes we can account for them thru the marriage of the six-foot father and four-foot mother or thru the marriage of a raw-boned, lanky man with a typal tapering

face to a mother, all of whose curves are ovoid. Sometimes defects in the dental germs or enamel organs cause disharmony of form, as in peg-tooth laterals. Sometimes the cause lies in disease of the skin or of a specific nature.

We have always recognized some of these disharmonies as displeasing. But there has been a tendency in the past to feel that the milder of these disharmonies were worthy of our admiration and imitation. We have placed tapering or ovoid laterals with square centrals and thought the unlikeness artistic, when it merely showed that we did not understand the principles of good art.

One of my friends, a prosthodontist of marked ability, has a grandmother for whom some one, years ago, made a set of dentures with conventional teeth of unsuitable shade. He has always known her thus, and he will not make for her suitable dentures, because he will destroy many of his precious memories and present associations. She would not be grandmother to him, if she were changed.

When we meet this feeling in ourselves or others, and when we yield to it in the selection of teeth which perpetuate a disharmony, we have confused our feeling with our art perception and have considered the disharmony more admirable. We definitely and deliberately displace art judgment for the sake of sentiment. That may be desirable in certain cases. Let us understand, however, what we are doing and why we do it.

Our duty, then, is to learn to read the dominant theme in the faces of patients as they present themselves, to select and arrange our teeth in harmony with that theme, to learn as much as we can about the subtility and beauty of nature's diversity of tooth forms in each type, and to avoid the introduction of a theme of our own which may be out of harmony with the theme set by nature.

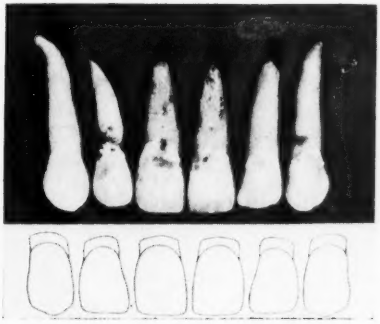

Fig. 2

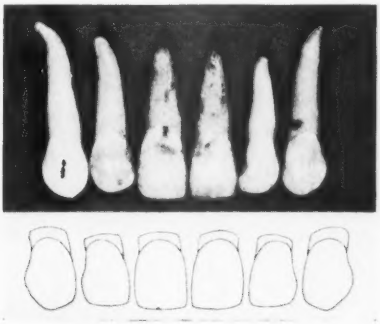

Fig. 3

THE DENTAL HYGIENIST—HER FIELD AND LIMITATIONS

By ALBERT H. STEVENSON,* D.D.S., New York City

(Read by C. N. Johnson, D.D.S., Chicago, Illinois, before the National Dental Association, Boston, Massachusetts, August 23-27, 1920)

DENTISTRY is now passing thru the most critical period of its history. With the responsibility for apical foci of infection laid at its door, as well as for the harmful effects of those types of restorations so assailed by Hunter and others, it has been necessary to perfect old methods and to initiate new ones to meet the needs of the present day. The average practitioner, having sensed this responsibility, is so burdened with the necessary readjustments of his methods that the very thought of the duties incidental to preventive work quite overwhelms him. And yet preventive measures cannot be neglected. We have educated the public to a respect for the oral cavity. How then can we be consistent and still be remiss in applying all available means of prevention in our private practices?

We are called upon to deal with the most common of physical defects. And conservative estimates place the number of carious teeth in the United States at four hundred million. We have had but little help from the dietitian, since he has not as yet completely solved the problem of calcium deficiency and the foods required to meet this deficiency. With the increase in the use of free sugar (the present consumption per capita in the United States is one hundred pounds per year), we must be prepared for an increase rather than a diminution in the prevalence of dental caries, according to accepted views.

In fulfilling the obligations of his calling, the average practitioner is the oral physician as well as a prosthodontist, and as such has his time fully occupied. He is seldom looked upon as a preventer of dental lesions, and yet this should be his enviable distinction. That he consign a portion of the work to a trained assistant is a secondary consideration. The fact remains that it is *his* obligation and *his* responsibility to see that preventive treatment is given.

The value of periodic prophylactic treatment in destroying bacterial plaques on the surface of the teeth is substantiated by latest research and investigation. After agglutination, the plaque is so tenacious as to resist removal by the most persistent use of toothbrush and dentifrice by the patient, and being usually invisible is not detected until decalcification of the enamel has occurred and the initial lesion presents. Even this stage often remains undiscovered, and it is not until the incipient cavity is in evidence that dental relief is sought. Intelligent use of the porte polisher will materially reduce this in the normal mouth. The periodical removal of the plaques is a preventive measure of prime importance.

It is with a false sense of security that the inconsiderate dentist disregards this important service. In addition to the infective material from mucosa plaques,

*Deceased.

desquamation of a more or less abnormal mucosa itself, with its accompanying debris, contributes to the pollution of the stomach and intestines.

The average mouth presenting for treatment to the oral surgeon or to the orthodontist (to say nothing of the general practitioner) is usually unfit for his ministrations. Incrustations of salivary calculus containing decomposing food, dead bacteria as well as living organisms in active proliferation, are present. To operate in such a mouth is to violate the laws of asepsis, and to prepare a cavity or even to take an impression under these conditions indicates a disregard for the health of the patient. The salivary deposits should be removed with the accompanying debris—in short, the field of operation should be properly prepared. This the dental hygienist can and should do. It is a procedure entirely consistent with and contributing to the dignity of the dentists' efforts and is comparable to the preparation of the field of operation for a general surgeon by his medical nurse. The licensed medical nurse has long been permitted to do this and no one has expressed the fear that some day, with the increasing number of votes by women, she will seek legal permission to take the scalpel in her own hand.

The dental hygienist is the sanitary aide of the dentist and can assume the duties without imperiling legitimate dental practice. On the contrary she will become as invaluable as those aides of the general surgeon—the pharmacist, the dietary expert, or the medical nurse.

Most state laws limit the work of the hygienist to the "removal of stains and accretions from the exposed surface of the teeth" or "under the free margin of the gum." Why should we be so fearful? Because in her perfectly legal perambulations she approaches the sacred gingiva? As a practicing periodontist, I yield second place to no man in my respect for the investing tissues of the teeth. But with all logic and consistency, I ask does the dental hygienist endanger the profession of dentistry because the perfectly hygienic operation of removing calcareous deposits and debris has a beneficial effect upon the periodontium?

From the very first, the student trained to become a dental hygienist has had impressed upon her that "her efforts should be limited to the plus side of the oral health line." She is told that she should not treat pathological conditions. I anticipate the question, "What is to prevent her from yielding to an impulse to investigate pyorrhea pockets, curette roots and otherwise infringe upon the province of the periodontist?" The answer is obvious.

Train her in the use of instruments designed for use within her field and educate her to a professional respect for those tissues beyond her province. This is being done at Columbia University and in other schools.

The possibilities of the porte polisher with wood points and abrasive and polishing agents are not appreciated by the average dentist. When properly used, this implement is more thoro than any device attached to the dental engine, and will reach points not accessible to any other prophylactic instrument. To obtain the best results with the porte polisher, considerable force must be applied to the enamel surfaces. The dental hygienist is trained in a technic that develops the capacity to make intelligent use of this force and a high degree of manual dexterity. She is taught this technic upon manikins before working upon patients. Polishing tape is used on all interproximal surfaces.

Education.—It would be most unfortunate for the cause of oral hygiene, as well as for dentistry, if these young women were poorly trained and inadequately equipped for the service they are called upon to give. The standards for her education must be beyond criticism. Her course of study is in a state of evolution and deserves earnest consideration by all those experienced in dental

education. The course which she is required to traverse should be in harmony with the dental course and should meet the demands of all those interested in higher dental education. In these early stages there is an opportunity for securing a uniform curriculum in all the schools that may not be available at a later period.

"Should the dental hygienist be educated in the dental college building?" This question propounded to the deans of twelve of the leading dental colleges resulted in eight affirmative and four negative replies. This is an evidence of a desire to associate the dental hygienist with the dentist even in training. By this association and environment she should acquire a respect for dentistry and all that it embraces, and should more fully appreciate her own limitations. This has been recognized by the directors of the Forsyth Infirmary. As a result of the recent affiliation with Tufts College, the school becomes the Forsyth-Tufts School for Dental Hygienists. In Rochester the university is to have a medical and dental school in conjunction with the Eastman Dispensary, thereby associating the school for the dental hygienist with the dental school.

The course of training should cover at least one collegiate year. It would be desirable to have the state law so constructed that graduates would be compelled to serve in recognized municipal or institutional dental infirmaries for another year before the granting of their licenses. Thus an additional period of training would be provided for, and a continuous supply of available workers for public institutions would be assured. This is successfully applied to school teaching and other callings, but would require strict supervision. Her preliminary education should consist of four years' high-school work or its equivalent, and credentials of character should be submitted before admittance. Preference should be shown those women who come from the professions of teaching or medical nursing. But excellent material may be found in the dental office, where the office assistant with creditable ambitions seeks to broaden her sphere of usefulness. The theoretical subjects should be those necessary to give her an intelligent grasp of the importance of her calling and of its relation to the work of the dentist. While I can learn of no objection to the lectures being given by members of the faculties of dental and medical schools, the efforts of at least one college to train dental hygienists in the same classes with dental students have been most unsatisfactory.

Practical work should consist of a course in tooth morphology, manual dexterity being acquired simultaneously with a knowledge of tooth form. The carving of artificial ivory blocks by hand fulfils this purpose. The operative technic on manikin heads as taught in Columbia University consists of three weeks' intensive training, with the use of porte polisher and wood points. The student is then taught instrumentation for three weeks on the manikins. When she has demonstrated the necessary aptitude she is permitted to give prophylactic treatments to patients in the infirmary, and devotes the remainder of the course to infirmary practice. As a result of this intensive training in specialized work, she emerges as a skilful, intelligent prophylactician ready to serve under the guidance of the dental practitioner. An important part of her training has been in the field of lay education. And she is prepared to give demonstrations in oral hygiene either in the office or the classroom.

Legislation.—All legislation concerning the dental hygienist should be initiated within the dental profession. As the work of these women is so closely allied to dental service, the dentist should always have legal as well as professional supervision over their activities.

Experience has proved that the legalization of the dental hygienist has furnished an invaluable aid to dentistry in-

stead of opening the door to illegal dental practice, as so many had feared.

Prior to the passage of the dental law of 1916 in New York state, the contention was made, particularly in New York City, that these women, if their vocation was legalized, could not be restrained from performing other dental operations. Conditions in New York City had been a scandal in the eyes of the dental world because of the flourishing of the illegal dental practitioner. The cosmopolitan population, combined with weak penalties in the law, made detection difficult and conviction no great hardship. It is hard to conceive of more unfavorable circumstances under which to introduce into the community a person legalized to give oral prophylactic treatment but restrained from doing more. But the same law that legalized the dental hygienist, defined dentistry concisely and made annual registration compulsory for both dentist and hygienist. Control over dental practice became at once immensely simplified.

In order to secure authentic data as to the possible violations of the law by dental hygienists, I communicated with the state department requesting a record of all prosecutions during the four years that the law had been in effect. I received the following reply from Dr Augustus S. Downing:

Albany, March 20, 1920

DEAR MR. STEVENSON:

I have your letter of March 17 and beg to say in regard to your inquiry as to whether licensed dental hygienists have violated, or are violating the dental law by performing dental operations other than those permitted under the statute, that up to the present time there have been no complaints of such violation, nor have our inspectors who have been active in investigating the work of dental hygienists with a view to making report upon the efficacy of licensing them found any occasion for criticising the operation of the law.

Trained, licensed hygienists are more and more in demand for public institutions and for private dental offices, but the larger percentage of the licensed hygienists go into public service under the supervision and direction of duly licensed and qualified dentists.

There is an increasing demand both in the cities and in the rural districts for the services of trained, dental hygienists in the schools, and I am satisfied that the provision of our dental practice act authorizing the licensing of dental hygienists was wisely conceived.

Most cordially yours,

(Signed) AUGUSTUS S. DOWNING

Since the legalizing of dental hygienists by statute in the state of New York in 1916, Connecticut, Massachusetts, Iowa, Maine, Colorado, Minnesota, New Hampshire, Oklahoma, Tennessee, and Michigan have passed similar laws; legislation is now pending in Illinois, California, North Carolina, Pennsylvania, Delaware, Virginia, and Georgia. With the exception of New Hampshire, Massachusetts, Colorado, and Michigan the laws limit this field to women and there is no evidence that even in these latter states the state examiners will permit them to qualify. Some of the state laws designate them as dental hygienists, others as dental nurses, which is unfortunate, as this tends to produce confusion among the laity. Legislation as well as education for the dental hygienist should be made uniform, and is more easily accomplished in the early stages of the development of this adjunct to dentistry.

THE RECORD OF THE DENTAL HYGIENIST

A survey of what has been accomplished by dental hygienists in various communities is most interesting. The record of five years' work of these dental hygienists in the schools of Bridgeport is the most forceful argument for preventive dentistry ever presented. It has been a topic of discussion among educational authorities as well as health workers thruout the country. During this period 125,950 prophylactic treatments were given to children and the latest records show that, of the 127 dental hygienists registered in Connecticut, 47 are engaged in public-school work, hospitals, dispensaries, or factories. During the progress of the war, many hygienists volunteered their services for work in the evening, and gave 800 prophylac-

tic treatments to men drafted into service. This is a record of which Connecticut may well be proud.

In New York state inadequate appropriation of funds has prevented the establishment of so enviable a record. The city of Rochester, aided by the Rochester Dental Dispensary, can show the best result for the state. A communication of recent date from Dr. H. J. Burkhardt reads as follows:

> I could not tell you the number of prophylactic treatments given in Rochester by dental hygienists, because until this year a considerable amount of the prophylactic work was done by dental internes employed here in the dispensary. Since January 1 the prophylactic work in the schools has been done by graduate dental hygienists and by students from the dispensary school. I expect before the first of July the dental hygienists will have done, from January to July, about 35,000 mouths. At the present time there are seventeen graduate hygienists and forty-two students at work in the schools of Rochester.
>
> You probably will be interested to know that since I have called in the graduate dentists who have heretofore done the work, I have had fewer complaints and less trouble than at any time since the work was started here. The work of the young women and their conduct generally in the schools is very much more satisfactory than when the men were employed. I am hoping to secure enough graduates from this year's class so that in the future I shall not be obliged to use graduate dentists again to do this work.

In New York City the municipality has been slow in providing funds to engage dental hygienists in the schools. As a result there are about sixty engaged in private practice with dental practitioners. Four others are in the service of the department of health; five are in the dental department of the Metropolitan Life Insurance Company; six in the charitable organizations, a total of fifteen in all. Twenty-five members of the alumni association of Columbia University, all engaged in private practice, have volunteered at least one morning a week for service in the public schools. As many of these young women are engaged by private dentists on a time basis, the service is a most commendable one. The undergraduate dental hygienists have given over twelve hundred prophylactic treatments in the Italian district this year, and almost half the class have indicated their intention of entering public work after graduation. One of our graduates sacrificed an excellent position to demonstrate the value of the dental hygienist at Mount Alto in this state, in response to the call of Dr. Beck. The students in Columbia University have given over fifteen thousand prophylactic treatments to date in the Infirmary.

In Massachusetts records show but two dental hygienists doing work in charitable institutions and two in the public schools, and Dr. Harold DeWitt Cross writes that the reason for this is, that "those who are most strongly in favor of legislation for the practice of dental hygienists have done nothing to promulgate the service in public health work." This is most unfortunate, and while not conversant with the reasons, I believe that it is but a question of time that with the increasing number of graduates from the Forsyth-Tufts school there will be many more available, if the opportunity is offered. The undergraduate dental hygienists have given about 17,200 prophylactic treatments in Boston in the last three years. Statistics from the other states are not available, but it must be borne in mind that their legal enactments are so recent that organized efforts could hardly have been carried on for a sufficient length of time to permit of tabulation. I believe the total prophylactic treatments given by graduate and undergraduate dental hygienists to date would aggregate 250,000.

Industrial Clinics

Consideration of the field of the dental hygienist brings us to the question of the industrial clinic. The operation of the industrial dental clinic involves some problems that reach so deeply into the fundamentals of sociology that they cannot be disregarded. Whether it is con-

ducted on a free service basis or a small fee basis is a difference of degree only. Moreover, anything that savors of paternalism is justly resented by the self-respecting worker as an infringement upon personal privilege and independence. For this reason you cannot enforce legislation for individual health, except where the ill health of one is a source of danger to the community. While it is generally accepted by the laity as well as by the employers of labor that dental efficiency increases industrial efficiency, there are limitations within which the efforts of the employer must be confined. The workers of today, particularly the skilled and unskilled manual laborers, are financially able to pay the fees of the private practitioner. The rapid increase in the rate of compensation of these toilers place them in a class to which even luxuries are not denied. Many have acquired means so much above their needs that they are spending with reckless abandon. By increasing instead of curtailing their hours of labor they could still further add to their income, and thereby have ample means with which to pay for proper dental service, incidentally bringing about a much-needed increase in production. The industrial worker needs not charity, but enlightenment as to his dental needs, and may then be relied upon to seek the private dentist who is prepared to give him the service he requires.

The industrial dental public clinic should be mainly educational. The employees may be given periodic prophylactic treatments and instruction in oral hygiene; the general dental service could be performed elsewhere. The clinic may also provide emergency treatment. I can conceive of isolated manufacturing or mining plants, such as the Colorado Fuel and Iron Company at Pueblo, Colorado, probably giving all types of dental service, since their inaccessible location prevents employees and their families from securing dental service otherwise. The same does not apply to those plants located in urban communities and companies assume a tremendous responsibility in operating general dental clinics in these places.

Can *real* dental service, worthy of the name, be secured from dental operators in these clinics as they are at present conducted? Most of the operators are young and inexperienced, and consider their position to be of a temporary nature. The very system of appointment and lack of prospects for future advancement discourage their best efforts. Unless all posts are carefully graded and well paid there is no incentive to give high-grade service.

I would particularly emphasize the menace of dental diagnostic work as carried on in some industrial clinics where there is no fixed responsibility. The taking and interpreting of dental radiographs requires diagnostic ability acquired only by experience, and is too important a phase of dental service to be performed at these clinics. It was to prevent irresponsible dental work that the law of New York state was amended, forbidding corporations to practice dentistry. So in our zeal for public service we should not indorse a return to another form of corporation dentistry with its old abuses.

Experience has shown the excellent results which can be obtained thru the program of preventive dentistry where the clinic is confined to oral prophylactic and emergency treatment.

A well-regulated industrial clinic devoted to the purposes stated above can, in addition to increasing the efficiency of the worker, become a forceful factor for health in a community. Such clinics deserve the heartiest support of every member of the dental profession.

Conclusion

I made the statement at the beginning of my paper that dentistry was passing thru a critical period. I am most optimistic as to the outcome, and believe it will emerge a more glorified profession

and will command the respect that the guardians of oral health deserve. In the meanwhile, the individual practitioner must keep pace and not mark time, nor must he be blinded by tradition or prejudice. This paper has touched upon only one of the phases of this necessary progression. By way of summing up, permit me to submit to you the following:

1. The dentist as the guardian of the oral health of the community can no longer disregard preventive measures as a part of daily practice.

2. The ravages of dental caries should be minimized by systematic oral prophylaxis under the direction of the dentist.

3. If the burden of professional duties prevent the dentist from giving this service to his patient he should provide adequate care in this field.

4. The dental hygienist should be properly trained and her activities be regulated by law. Where she has been given opportunity she has met all expectations.

5. Whether she serves in a private office or in public institutions she is rendering humanitarian service. The distribution of her labor will ultimately be adjusted by the law of supply and demand.

6. The dental hygienist is an important factor in the progress of dentistry and the elevation of her service is a matter of concern to the dental profession.

7. It devolves upon the dental societies to propose appropriate legislation legalizing the dental hygienist in every state in the Union, as all such legislation should be initiated by the dental profession.

As an appendix, permit me also to present in outline form what I conceive to be the field of the dental hygienist.

THE FIELD OF THE DENTAL HYGIENIST

PRIVATE PRACTICE	Preparation of Mouth for Operator	General Practitioner, Oral Surgeon, Orthodontist, Periodontist
	Periodic Prophylaxis	
	Instruction to Patients	
CHARITABLE INSTITUTIONS	Hospitals: Ward Service, Bedside Oral Prophylaxis	
	Orphanages	Oral Prophylaxis — Toothbrush Drills and Instruction to Children
	Settlement Houses	
	Community Clinics	
HEALTH CENTERS: Co-Operation With Public Health Nurse		
SCHOOLS	Public Schools	Examination of Children. Prophylactic Treatments. Instruction in Oral Hygiene
	Parochial Schools	
	Private Schools	
INDUSTRIAL CLINICS	Educational Program for Employees	
	Periodic Prophylactic Treatments	

DISCUSSION

Alfred C. Fones, Bridgeport, Connecticut: In the prevention of dental caries the great factors are education, dietetics, and cleanliness. In order to create interest in education and dietetics, we start on the simple process of cleanliness. We find that when children have clean teeth and realize the sensation of a clean, wholesome mouth, they become interested in mouth hygiene. And after they have had a little education on the general topics of hygiene, they are willing to consider your arguments as to what they should eat, even to the giving up of refined sugar.

The most difficult thing is to get a message into the homes, and have it carry any weight.

The seeping of such knowledge into the minds of the parents means years and years of work. If we were all agreed, as a man, upon some definite process to be followed to bring about the results we are striving for, it would still take years to accomplish it. The only way to get at it is thru a generation of education in our public schools. We are all set in our habits even with the intelligence which we may have. But children can be taught good habits for in the public schools the hygienist becomes a teacher, and as a teacher her word becomes law to the children. And that word is carried home, many times, possibly, with more influence than we realize.

It is slow work, but it is coming. I remember when we first started in school work that only about ten children in one hundred were brushing their teeth daily. Now we do not find ten children to one hundred who, when entering school in the first grade, do not own a toothbrush. Why? Because brother and sister have taught them that they must have a toothbrush, and they bring money, not only for brushes for the littler ones at home, but also for mother and father and for sister and brother who are working. We sell them at cost and are glad to do so.

Dr. Stevenson presented the main issues of dental hygiene, the main issues for those who have been doubtful as to the necessity for the dental hygienist. The arguments are convincing, even to the skeptical.

I am presenting our sixth annual report of the work of the dental hygienists in the public and parochial schools of Bridgeport, for the year ending 1920.

A year ago I published a report of our findings for five years and the comparison of the statistical children of the fifth grade with those of the control class taken five years previously. Possibly some of you have read that report. This sixth-year report merely emphasizes the splendid work these hygienists are doing and is, I consider, an added argument to Dr. Stevenson's paper:

"The Division of Dental Hygiene submits the sixth annual report of the educational and preventive dental clinic in the public and parochial schools, from September 10, 1919, to June 25, 1920, inclusive of the summer clinic of 1919.

"The dental corps comprised twenty-one dental hygienists (one on half-time), two supervisors, and an assistant supervisor, who are also dental hygienists, and three women dentists.

"In the years previous to the petition of the parochial school to be included in our clinic, a corps of twenty dental hygienists was required to provide adequate prophylactic service for the children of the first five grades of the public schools. Six additional hygienists were needed to extend this service to the parochial schools, and altho we were able to secure these workers in 1918, our corps has been gradually depleted, and the lack of a training school for dental hygienists in Connecticut has made it impossible to secure more hygienists.

"In spite of this unfortunate situation the children of the parochial schools each received one prophylactic treatment this year.

"Total number of individual children receiving prophylactic treatments.....20,918

"Total number of prophylactic treatments given.....28,012

"The supervisors and dental hygienists gave instructions in the home care of the mouth by means of toothbrush drills and classroom talks to 22,587 children. The children purchased 10,235 brushes, and many more brushes could have been sold if it had been possible to secure them. Every child is required to have a toothbrush, and an evidence of the increasing interest in mouth hygiene is the willingness of parents and children to pay for the brushes. Only 543 brushes were given away this year, a reduction of 931 from last year.

"It is our aim to gradually increase the general educational field of the hygienist in the classroom, especially as regards correct diet, and during the past year two dental hygienists have spent considerable time in the second to the fifth grades giving a series of practical food talks. At the completion of these talks the fifth-grade children prepared original menus for one day, covering the food requirements of the body. This education was given to 7,190 children. In fact, practically all the educational work for the year was centered on foods, and the pamphlets and lectures with lantern slides given by the supervisors and school dentists to 10,613 children dealt with correct diet and the need for restricting the use of free sugar. The mouth as the important factor in the spreading of communicable disease, such as influenza, was also a lecture subject.

"The efforts of our three women dentists are concentrated chiefly upon the safeguarding of the first permanent molars of the children of the first and second grades.

"The results of this important service is shown by the following: In 1915 the examination of the first permanent molars of the fifth-grade control class showed that 15.1 per cent of these molars had been lost. Our records this year show that but 7 per cent of the first permanent molars have been lost—a saving of over 50 per cent more molars as a result of the filling of the fissure cavities when these children were in the first or second grades, and the teeth had just erupted.

Total number of individual children having teeth filled..... 889

Total number of sittings.....2,573

Total number of first-grade children worked for	37
Total number of second-grade children worked for	827
Total number of third-grade children worked for	23
Total number of fourth-grade children worked for	2
Total number of alloy fillings in permanent molars	4,566
Total number of molars filled	2,443
Number of treatments for the relief of pain	7
Number of extractions of loose deciduous teeth	1,507
Number of treatments for children above second grade	44
Number of extractions of abscessed deciduous teeth	4,491

"The extraction of a large number of abscessed deciduous teeth marked a new procedure this year, this service being provided for any child up to the fifth grade in order to remove, as far as possible, any dental condition that would be a menace to the child's health.

"The report of last year [1919] completed a five-year demonstration of this type of educational and preventive clinic and showed very gratifying results. The present report [1920] will be based upon the data of the condition of the mouths of those children who have had five years of prophylactic treatment and education, but have had no general operative work provided for them.

"In 1919 the average reduction of dental caries in the permanent teeth in thirty schools was 33.9 per cent in a five-year period as compared with the control class. A similar comparison for 1920 shows a reduction of 49.6 per cent dental caries in the permanent teeth.

"Following is a table of the record of individual schools.

"The children passing into the sixth grade are out of the general supervision of the hygienists, and due to our rapidly increasing population many hundreds of these children were newcomers in the past two or three years and therefore are not statistical children. In order to send as many of them as possible into the sixth-grade with clean mouths and sound teeth, a prize was offered to any pupil in the fifth-grade who at the last examination would present a clean mouth with no cavities in the permanent teeth. There were 551 children who passed this examination and received prizes. It must be considered that these children went to a dentist of their own initiative to have the permanent teeth placed in a sound condition, and had also kept their mouths clean from food debris by systematic brushing.

PERCENTAGE OF REDUCTION OF DENTAL CARIES IN PERMANENT TEETH OF STATISTICAL CHILDREN

School	1919	1920	School	1919	1920
Jefferson	17.0	53.1	Sheridan	57.4	50.0
Black Rock	33.8	63.2	Huntington Road	59.2	14.8
Prospect	58.8	48.8	Waltersville	16.2	10.8
Whittier	minus	5.0	Kossuth	59.6	74.1
Jackson	25.0	36.5	Franklin	51.6	62.9
Longfellow	19.2	34.6	Summerfield	45.3	37.5
Bryant	23.8	58.7	McKinley	minus	35 4
Maplewood	52.8	83.0	Newfield	26.1	50.0
Elias Howe	23.8	minus	Lincoln	41.8	34.5
Grand	57.8	54.3	Garfield	26.5	20.3
Columbus	17.0	87.2	Washington	31.1	85.2
Read	2.1	minus	Staples	45.7	34.2
Webster	19.7	64.2	Wheeler	30.1	39.6
Shelton	28.0	62.0	Barnum	67.5	84.4
Madison	22.0	54.0	Hall	25.0	68.7
	Average reduction			33.9	49.6

"Only thru education and an appreciation of the importance of sound teeth could these children have been induced to go to the dentist in such numbers, for altho the prize was an incentive, it would not attract the average child sufficiently to undergo a dental operation to secure it. In other words, the result of systematic education was that these children upon their own responsibility sought dental service and maintained clean mouths by faithful brushing, developing what might be termed a *dental conscience*."

Everyone knows that it is insanitary to spit on the sidewalk; we know the dangers of the expectorations from the mouth, and yet how many of us have a sanitary conscience and will not spit on the sidewalk?

"We believe this record makes a favorable contrast to a general repair clinic where the mouths of children are put in good condition

because those in charge know the importance of it. To the child it is too liable to mean merely an operative ordeal, and owing to the lack of education and appreciation of sound teeth the child fails to keep the mouth in good condition.

"In connection with this discussion it has been thought interesting to give in detail the condition of the mouths of our fifth-grade children as a whole, irrespective of statistical children in comparison with the data of the control class of 1915.

Year	No. of Pupils	Grade	State of Health			Color of Gums			Fistulas	Malocclusion	Use of Toothbrush			Cavities	
			Clean	Fair	Dirty	Dark Red	Light Red	Pink			Daily	Occasionally	Not Used	Temporary	Permanent
1915	1946	5	77	658	1211	581	1244	121	142	1867	307	1060	579	2006	10726
1920	2313	5	1105	1005	203	126	1361	826	92	2294	1381	852	80	3266	7393

"We find upon careful examination of the permanent teeth that this year the entire fifth grade averaged but 3.2 cavities per child in contrast to 5.5 cavities six years ago. It is interesting to note the general improvement in the mouths of these children, many of whom have been in our school system but a comparatively short time.

General Comments

"The splendid results which are being accomplished in mouth hygiene for the children in our schools have been largely due to an efficient and loyal corps. The dental hygienist evidently recognizes and appreciates her great field of service in public health work, for we have had but two cases of members of our corps leaving for work in private offices.

"This is a noteworthy record and proves conclusively the interest of women in this work, for, unfortunately, in Connecticut we have had no training school for hygienists since 1917, and altho the value of dental prophylaxis in private offices has been increasingly recognized, our corps has remained loyal to public health work over a period of six years.

"Previous to September, 1919, the school work was handled entirely by a traveling corps of hygienists with portable equipments. The corps remained in a school until the work was completed and then moved to the next school, returning at a later period. The interest in mouth hygiene in the intervals between the visits of the hygienists depended in a great measure upon the influence of teachers.

"In September, 1919, we placed a resident hygienist in certain schools and a comparison of the records with those of the traveling corps indicates that this procedure would be ideal if sufficient hygienists could be secured.

"We intend this year to locate as many resident hygienists as can be spared from the traveling corps. A few of the many advantages of this plan are as follows: A reduction of the number of children with whom she comes in contact and works for enables her to remember the mouths of individual children and to give special help in cases which need it. Her constant presence in the school is a daily reminder of clean mouths and sound teeth to all the pupils and teachers in her school. She is able to carry thru lively competition between rooms for the reward of clean teeth banners, honor rolls, etc. Her undivided interest in the children of one school brings her in touch with the parents who are frequent visitors at her clinic.

"It is apparent that the improvement in any school depends materially upon the co-operation of principals and teachers with the hygienists and our records will show how heartily this help has been given. The personal attitude of the teacher means much to the child, and it is invariably true that the best records come from the room of the teacher who has an appreciation of mouth hygiene. This is forcefully illustrated in the case of the McKinley School, which had a minus record for 1919. The determination of the individual teachers to aid the hygienist in improving the record of this school included competition in daily brushing which resulted in five rooms of 100 per cent dividing the banner for one semester, one of the five having a record of 100 per cent for the entire year."

This means that every child in that room from September to June never failed once in the brushing of his teeth, mornings, and afternoons before he came to school, which we think is a wonderful record and a gratifying response to the teacher's efforts. In addition to this seventy fifth-grade children out of one hundred were prize children for clean mouths and sound permanent teeth, and the statistical children showed a reduction of 35.4 per cent in dental caries.

Many other evidences of intelligent co-operation in other schools could be mentioned. This report is only one evidence of the excellent service rendered by the dental hygienists. This great cause of prevention is limited only by an inadequate supply, at the present time, of women educated and trained as dental hygienists. The future looks very bright, however, as training schools are on the increase, and eventually I hope to see one established in every state, for the need in each state is so great that it must be supplied in this way.

SILVER REDUCTION METHOD, APPLIED AT FORSYTH DENTAL INFIRMARY CLINICS

By HAROLD DeWITT CROSS, D.M.D., Boston, Massachusetts

(Read before the National Dental Association, Boston, Massachusetts, August 23-27, 1920)

Difference Between Institutional Dentistry and Private Practice

IN ORDER to present in a suitable light a report on the use of the silver reduction process at the Forsyth Dental Infirmary it is necessary to go into some detailed explanation as to the function and differentiation of institutional dentistry and private practice. It is not intended to convey the idea that the fundamental dental practices or technic are essentially different, but that their application is, and that what may be a necessary and proper policy to pursue in private practice may not be suitable for institutional work. There is a responsibility which is necessarily a part of an institutional dental policy which is practically never felt by the private practitioner. The institution is confronted with the necessity of organizing its work and technic in such a way as to accomplish the thing that is most needed to advance the dental condition of all who by location or condition in life ought to become its patients, in other words, to do the most good to a large number of a particular group of individuals. On the other hand the private dentist does not entertain any such responsibility, and while actuated by high professional ideals, doing his work in a proper, creditable, and professional manner, he works only for as many individuals as come to seek his services, content if conditions work out so that he cares for few or many, providing his time is profitably occupied, and he has no anxiety regarding the many in his city or town who do not obtain his services. There is a vast difference in starting out to accomplish some definite results for a large number of people in a given community or group, or merely beginning practice in a community for the few who come to the private office.

This condition is recognized by all who have had practical experience in public clinic work, but to one without this particular experience it seems strange. The institutional viewpoint is different. It is broader in its desire of accomplishment, and it is to this viewpoint that preventive dentistry owes much of the incentive of the last few years, whether it be thru public dispensaries, school dental clinics, or the large grouping of men in the dental clinics of the army camps. Such things result only when there is a large vision and when there is the desire to accomplish definite things on a large scale.

Institutional dentistry requires the application of policies in an *impersonal* but not in a *heartless* manner. It requires the sacrifice of the individual for the good of the many. During the war it was only by standardized production that the necessary quantity of the various

materials needed was produced. Education used to be the exclusive possession of the privileged few, but when it was brought within the reach of the masses it had to be altered from the development of high degrees of individuality to fit the needs of large groups of people.

The interest in root-canal work which has been prevalent during the last few years has made it necessary for all to become interested in this subject, both the private practitioner and the institutional worker.

A Definite Policy of Preventive Dentistry

The Forsyth Dental Infirmary does not follow the plan of treating root-canals to any great extent as a fundamental policy, for the reason that after a short time it was found that no real preventive work could be accomplished and that it would also limit the number treated very greatly. This plan was a part of a definite policy to accomplish prevention to as great an extent as possible by utilizing the time required for root-canal treatments in filling initial cavities in temporary teeth and in the six-year molars. The plan not to treat six-year molars—to extract those with involved pulps, or roots not fully ossified—is only preliminary to the definite policy of reaching the cases before these things become necessary, only the advance guard of a policy of preventive dentistry. And we feel confident that not many years will elapse before the number of extractions will be very greatly reduced. From this viewpoint it is not a question of how successfully can root-canals be treated, but of reaching as many as possible before pulp involvement has occurred and root-canal treatment is required. To assist in this plan of substituting preventive for curative treatment it has been necessary to reduce the age limit of initial treatment, which from twelve to fourteen years during the first year of the clinic has been brought down during the past year to an average of from six to seven years. This lowering of the age limit has also materially aided in increasing the number of children which can be treated in a given time.

For the reasons mentioned above no method of canal treatment could be adopted as routine except in the small number of cases coming under the plan, which are mostly anteriors. Therefore in order to test out the silver reduction process it was necessary to apply it to a relatively limited number of cases. Following the general plan of having groups or squads of internes for all special work, a group was assigned and given instruction by Dr. Percy R. Howe, first in the laboratory and later clinically. It is from data of cases treated in this way that the following is compiled.

Sterilization by Application of Silver Reduction Process

While the treatment of root-canals, especially in posterior teeth, required a divergence from routine policy, the application of the silver reduction process to incipient cavities, the actual bathing of the occlusal surfaces of temporary teeth and of six-year molars, or its application to superficial or deep cavities was made a daily routine procedure. In fact $AgNO_3$ was much in use at the Forsyth clinics before this improved process was brought out. In all of these various applications as a preventative before actual caries had begun, to sterilize cavities or pulps, as a pulp capping, or in the more complicated process of root-canal sterilization and filling, the silver reduction process has proved a most satisfactory one, being easily and quickly applied and resulting in definite and permanent sterilization.

Before giving the results of actual experiments and clinical treatments it may be worth while to briefly review some of the features of the silver reduction process as devised and applied by Dr. Howe.

Features of Silver Reduction Process

It consists, as you know, of the reduction from a solution to the actual metallic silver, similar to the process involved in the "silvering" of mirrors. Therefore this metallic deposit is permanent, and being composed of finely divided particles it penetrates in its liquid form into the minute tubuli or thru foramina of any number or location. This penetration is not hindered to any extent by the presence of debris in the canals, or by the presence of moisture, or by gravity, as by capillary attraction the silver solution travels up thru a canal as readily as downward. Another property possessed by the silver solution is that of penetrating only diseased tissue, its progress stopping promptly when meeting healthy substance. On this account there is no danger of the solution attacking the special tissue just beyond the foramen, unless it is carried there by means of a broach. And last, but by no means least, is its antiseptic property, which is practically absolute as applied to bony tissue, and this absoluteness exists not only on the surface but as deeply as the solution penetrates. This has been proved many times by testing layer after layer of shavings removed from cavities and canals before and after the application.

The process is not a lengthy one, and in all ordinary cases one treatment, giving several applications if necessary, is sufficient to produce results. This feature is of great importance in institutional work, as it permits more work to the individual and more individuals to receive treatment. It was the long time required for root-canal treatments that originally compelled the adoption of the removal of putrescent six-year molars. The technic of the process is easily acquired, and internes who show interest in the work very quickly become sufficiently skilled in treating cases so that scarcely any failures occur, and rarely is more than one sitting required, even for quite serious cases. A few failures in the beginning are from the same causes as are those of private practitioners, viz., forcing the solution thru the foramen and thereby causing pain, for it is always to be remembered that this silver solution is exclusively for bony tissue, and should never be brought in contact with any soft tissue.

While the carious process has been found to extend in medium sized cavities nearly if not quite to the pulp, and even in shallow ones, it is impossible to remove all of the decay by the use of burs; however, it is both possible and practical to sterilize the dentin by means of the silver solution. And even tho the policy has been adopted to begin the care of children's teeth at such an early age as not to require either the sterilization of deep caries or canal treatments, yet for many years there will be enough individuals requiring this treatment to make it a most valuable asset in both institutional and private practice. The possibility of avoiding the unnecessary using up of tooth material by excavation in young children should be of inestimable value later in life, while the possibility of eliminating or forestalling the process of caries in children's teeth which show pits or defects in formation cannot be overestimated.

Policy of Forsyth Dental Infirmary

The policy of the Forsyth Dental Infirmary is to endeavor to have the children come to its clinics at as early an age as possible after the eruption of

the temporary teeth, and to treat them preventively by instruction and application; to see the child every three or six months thereafter; to forestall complications with the temporary teeth and the six-year molars, and all of the permanent dentition. In cases where thru lack of knowledge or opportunity the child arrives with badly broken down temporary teeth and involved six-year molars, the policy is to extract or treat and fill, according to conditions, preference being given to extracting ordinarily; to fill cavities, large and small, even including those with pulp exposure; and to dismiss all cases, whether arriving young or at a later age, with a clean and healthy mouth, with no diseased roots or teeth which can in any manner be said to be a menace to the health of that child.

We may possibly look upon all problems of extraction and root-canal treatment as merely incidental and temporary, and not as a fundamental or permanent structure upon which the dentistry of the future will stand. Undoubtedly preventive dentistry is well on its way, and to accomplish this it is absolutely necessary to begin its application to young children. If this is done systematically, both in institutional and private practice, and carried out as well as is now known, there should be little need of using even a very serviceable and practical method of canal technic.

In all of this routine the silver solution finds a ready and necessary application and is the real mainstay treatment. No process has been devised which has contributed more to the successful practice of present-day dentistry or for the more important preventive dentistry of the near future.

BETTER DENTISTRY FOR MORE PEOPLE

By ARTHUR B. CRANE, D.D.S., Washington, D.C.

(Read before the District of Columbia Dental Society, 1920)

PERHAPS there is no recent innovation in dental practice which has done more to benefit the public than the adoption of oral diagnosis. The mouth-mirror dentist of yesterday who saw nothing in the mouth but teeth or spaces where false teeth might be placed has given way to the dental scientist who, with the assistance of the X-ray, the electric current, and the study model, considers the mouth in its relation to the general health of the individual. This change has eliminated the tooth as the unit of dental procedure and established the interrelation and interdependence of all dental operations.

If any argument were necessary to justify the necessity of adopting the mouth as the unit, it would become self-evident after a few examinations, for it must be acknowledged, to the shame of the rank and file of the dental profession, that the general public has not been greatly benefited by our past operations.

Amalgam plugs, mother-hubbard crowns, septic bridge-work, squash-bite plates, and gingival and periapical infection are so commonly encountered

that the adult mouth in which these dental crimes have not been committed excites wonder and comment.

If it could be claimed in extenuation that such operations were the result of a defensible ignorance of dental requirements, the odium might be less, but there have always been men in the profession whose teachings were the result of broad scientific vision. Before the majority of the men had begun the study of dentistry Black had established a scientific method of cavity preparation and tooth filling, George Evans and Peso, correct principles of bridge-work, and Bonwill, anatomical articulation and clasp dentures. Green had taught correct impression taking and Rhein and Callahan the necessity for painstaking root-canal operations. D. D. Smith had laid the foundation for dental prophylaxis and Darby had shown the need for careful diagnosis. These advanced teachings, for the most part, were received with derision or at best met with considerable argument.

The discovery by the laity that defective teeth are often the cause of serious and even fatal diseases has resulted in a demand for better dentistry. The education of the public in the prophylactic possibilities of modern dentistry (so called) will continue and increase. Articles in popular magazines and newspapers, advertising campaigns of dentifrices, the public-school dental service, and the condemnation of thousands of physicians will tend to make the patient so intelligently critical that dental debauchery will no longer be tolerated. If the general public ever comprehends the difference between dentistry as it should be practiced and dentistry as it is commonly practiced, the toothtinker who continues to do dental patchwork will find that his days are numbered.

This is a harsh indictment and is in no way intended to apply to the practitioner who is attempting to follow the best of modern dental teaching, but before claiming that the shoe does not fit, let us examine our routine procedures and consider whether we have mastered a technic which satisfies the requirements of modern dentistry.

Do we understand a method of cavity preparation which not only looks to retention, but accomplishes a high degree of immunity from recurrent decay? Is our knowledge of dental anatomy so complete that we are able to make perfect contact points, contours, and occlusal restorations? Do we know where the gold inlay is superior to the amalgam filling and where it is contra-indicated? Are we able to conserve the dental pulp and can we, with a reasonable degree of success, treat and fill the root-canals of pulpless teeth? Do we comprehend the causes leading to pyorrhea and understand the practice of prophylaxis? Have we mastered a system of bridge-work which insures a clean mouth and does not require or cause divitalization of the pulp? Can we construct a denture with valve suction and anatomical articulation? Does our system of record-keeping permit us to know definitely how often it is necessary to see individual patients in order to accomplish preventive dentistry? These are but a few of the questions which must be answered in the affirmative before we can claim that our practice is in accord with the best thoughts of modern dentistry.

It has been variously estimated that but from 10 per cent to 30 per cent of the people avail themselves of regular dental attention, but the popular educational propaganda which has been referred to is daily increasing the demand. Every dentist in a large center of population finds his time more fully occupied and many are turning patients away. The more exacting requirements of our modern technic make it impossible for the dentist to attend as many patients as formerly. Meanwhile the dental schools are raising their entrance requirements, lengthening their courses, and increasing their fees, and

thus it occurs that the number of new graduates is diminishing while the demand for dental service is increasing. The natural working of the law of supply and demand has tempted the dentist to charge and induced the public to pay a generally increased fee. It thus happens that many people of limited means are seeking the services of the advertising dentist or worse still, perhaps, of so-called ethical dentists who unscrupulously slight their work in order to produce a large volume of dentistry at a reduced fee.

It must be accepted as an economic fact that modern dentistry cannot be performed at old time-reckoning, for even if the dentist is satisfied with the same remuneration per hour for his work it takes so much more time to accomplish the finished product now demanded that the final cost of each operation must be considerably increased. Any man who would continue the same hour-charge, however, would find his net income reduced more or less in proportion to the extent to which the high cost of living has affected his overhead.

What shall we say then? Is modern dentistry to become the rich man's luxury, while the poor man dissipates his pittance in having his teeth ruined and his health endangered by the discredited technic of yesterday? Such a consummation is to be earnestly deprecated by all right-thinking individuals. It is time that as a profession we stop to consider ways and means of producing modern dentistry for more people at a price which they can afford to pay.

How can this be accomplished? I frankly admit that this question has caused me grave concern and has been the subject of many a heart-to-heart talk with professional friends. The outcome of this consideration has been the formation of a few constructive conclusions which may have a beneficial tendency. The following are some of the suggestions:

1. *The more universal employment of dental hygienists.*—There has been so much said upon this subject pro and con that perhaps no new argument can be presented. While it is obvious that many of the girls trained for this work are undertrained and incompetent, that many of them are being used to the commercial advantage of their employers, and that the limitations of their instrumentation cannot generally be controlled, nevertheless, under proper restraint they can render a very effective modern dental service for a large percentage of the population, and do so at a fee considerably lower than most dentists could afford to accept. Is it not somewhat strange that dentists, who, with rare exceptions, have been satisfied to skim over the teeth with a couple of scalers and a brush wheel in the engine, who have never been widely known for their philanthrophic endeavors, and who have more or less infringed upon the sphere of the doctor of medicine, should now raise their voices in alarm for fear the dental hygienist may be guilty of similar errors?

2. *The formation of societies of dental nurses, with the establishment of a registry.*—A properly trained dental nurse will make increased production possible in any dental office. This is not a plea for the novel-reading school girl type, whose services can be had for a few dollars a week, but the refined, educated serious-minded young woman who can appreciate the dignity of aiding in the administration of comfort and health thru the practice of modern dentistry. The time-saving service and financial advantage of having such an assistant has been gone into at length by better qualified writers, but it would seem that the time is ripe for the dental profession to do something to attract the right kind of girls to adopt dental nursing as a life-work. As a step in this direction I suggest that such dental society establish a registry, wherein after suitable examination a girl who has spent one year or more

training in a dental office could be certified as a registered dental nurse. The formation of societies of dental nurses, with membership limited to those who are registered, would be a logical outcome of this expedient.

3. *The formation of societies of dental laboratory assistants.*—These societies would include in their membership not only the workers in private offices but those connected with commercial laboratories as well. I am aware that the step from such a technical society to an organized labor union is but a short one. As so much of the atrocious prosthetic work which one sees in human mouths is the result of careless incompetent laboratory work, performed by men who have little or no conception of the vital requirements, even the union would be welcomed with all its attending evils, if it only resulted in the production of better dentistry.

4. *The formation everywhere of definite technic clubs.*—One cause of poor dental work, until recently unperceived, is that the dental profession as a whole is suffering from mental indigestion. The careful analysis of almost any program of a dental meeting will disclose the greatest hodgepodge of dental ideas imaginable. Almost every conceivable operation in dentistry is exploited and the studious dentist who tries to assimilate it all, rushes from one thing to another with such rapidity that upon the conclusion of the meeting he finds he has but a confusion of ideas. In the past few years an attempt has been made to limit to some extent the number of clinicians and essayists at dental meetings, by the substitution of the postgraduate clinic for the old-time panorama. But even this does not go far enough, for the attempt is made to accommodate too many men and the time alloted for each course is so short that the merest smattering of knowledge is thereby imparted. Men speak of "Dr. So and So's technic" and practice or condemn their conception of it, when in reality they are only acquainted with it in part. This often results in operations, which might be compared to an automobile with a Rolls-Royce body, a Ford engine, and wagon wheels. As has been said, this is a symptom of mental indigestion, and the remedy is the temporary use of predigested food. The definite technic clubs, then, should be organized for the purpose of obtaining their dental knowledge predigested. These clubs should consist of twelve to fifteen active members who will unite to obtain the instruction of available men who can present a *definite technic.* The courses must be so arranged that sufficient time will be devoted to one instructor to enable him to thoroly impart the method which he has to present, and after the course is completed the members must continue to devote their efforts to this particular technic until it has been mastered *in toto.* Then and only then may the club proceed to new instruction.

The definite technic club is not to be confused with so-called study clubs. These have served and are serving a useful purpose, but too often study has been conspicuous by its avoidance, and dentists have tried to absorb technic by observation rather than by doing the work with their own hands, under supervision of the instructor, as the definite technic clubs will do.

Let anyone stop to honestly consider the amount of time which is consumed in his practice by make-overs or failures to carry operations to completion as originally planned and he will realize that the mastery of definite technic in any operation, the steps of which could be proved as the work progressed, would result in more or less daily saving of time, which would enable him to serve more patients. Thus, for instance, if a dentist can know in the beginning that a certain tooth cannot be saved by treatment, he has from three to ten hours to devote to other work the instant that he extracts it; or the dentist who has

a technic for testing the suction of a plate when the impression is taken often has from two to eight hours to serve other patients, which might otherwise be consumed in making the plate over. But this is not all that the definite technic club should accomplish, for each club should invite from three to five of the men who have recently opened offices in the community into the full enjoyment of all privileges of the club as associate members. This privilege is to be extended without dues or assessments of any sort, for the purpose of training the new men in definite technic. Thus, when a patient presents for treatment at the office of a club member and finds himself unable financially to meet the required fee, there will be in the community men whose time is of much less value to whom he can be conscientiously referred for service, and he will therefore be able to secure modern dentistry for a fee that he can afford to pay. The newer practitioner will have his time more fully occupied, more of the public will be efficiently served, and less patients will be driven by financial insufficiency to patronize the advertising office or other unscrupulous dentists. The associate membership privilege should have a time limit, of course, and should carry with it the obligation to join or organize a definite technic club upon its expiration.

In conclusion let me add a poem, which appeared in *Dental Quarterly* (May, 1919).

WHY, THAT DELIGHTFUL DENTIST

By La Touche Hancock

In children who my first array
Of teeth plucked tenderly away,
For teeth, like dogs, have each their day?
My Dentist.

Who, when my first had run their race,
And others had usurped their place,
When overcrowded, gave them space?
My Dentist.

Whether the cavities were slight,
Or vast and deep, who stopped them tight,
Then made the polished surface white?
My Dentist.

When voids appeared, and gaps were seen,
Who fixed the vacancy to screen,
An artificial one between?
My Dentist.

Who lulled with gas my every fear,
When conscious that a tug was near
For man's endurance too severe?
My Dentist.

And, lastly, when infirm I grew,
Who skilfully each relic drew,
And framed for me a mouthpiece new?
My Dentist.

If this is a fair picture of the outcome of a lifetime of dental attention, and who can deny that it is too often the unexaggerated result of our past methods, then it is time that something should be done to rectify conditions.

THE HISTO-PATHOLOGY OF DENTAL GRANULOMAS

By GUTHRIE McCONNELL, M.D., Cleveland, Ohio

From the Research Institute of the National Dental Association

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BEFORE taking up in detail the discussion of the above it seems advisable to state why the term "granuloma" is used. Various men object to it on the ground that any word ending in "oma" implies that we are dealing with a condition allied with the neoplasms or new growths. In the earlier days the tubercles of tuberculosis and the gumma of syphilis were thought to be forms of tumors and were referred to as "granulomas," tumors of granulation tissue. As their structure was more carefully examined it was found, however, that they did not belong to the true type of new growths. For some time they were spoken of as "infectious granulomas" and the phrase restricted mainly to certain chronic forms of inflammation, such as caused by the organisms of tuberculosis, leprosy, and syphilis. By degrees the term "granuloma" has come to mean an overgrowth of connective tissue, chronic or subacute in its course, and characterized by the absence of polymorphonuclear leucocytes and the presence of plasma cells. To speak of these lesions as "apical abscesses" is incorrect for, except in comparatively few instances, these characteristics belong to the true abscess. There are not found the acute changes, accompanied by a collection of pus cells, such as form the cardinal symptoms of inflammation. For the above mentioned reasons the word "granuloma" is used to designate this particular form of lesion found at the apex of devitalized teeth. In order to get a clear understanding of all the factors concerned in the formation of the granuloma it will be well to review, to some degree, the normal anatomy and physiology of the teeth.

The portion first encountered is the enamel, which is composed of the "enamel prisms" firmly united to each other by a very thin layer of interprismatic substance. Altho this is the hardest and densest tissue of the body, the question is by no means settled as to whether it represents a final stage of non-vital existence, or whether it is still influenced by internal and external changes. Pickerill[1] discusses this matter at great length. In connection with the post-eruptive hardening of the enamel, the point obviously arose as to whether this came about from within or from the outside, namely, whether or not calcium salts could be passed in solution from the dentin to the enamel and there deposited. According to his experiments already reported,[2] such a process does not occur. He reports in his latest paper several experiments supporting his

[1]"The Structure of Enamel," Dental Cosmos, LV, (October, 1913), 969.

[2]The Prevention of Dental Caries and Sepsis (1st Eng. ed.), 96.

opinion as previously expressed and comes to the conclusion "that there is not sufficient evidence to show that normal secretions or body juices may pass from the dentin to the enamel." Other investigators, such as Williams, Hopewell-Smith, Black, Noyes, etc., do not believe that the enamel is capable of being built up or broken down as a result of general bodily conditions, nor that it undergoes any nutritive or metabolic changes. Hopewell-Smith refers to the enamel as a "dead body."

There are, however, other men who are as firmly convinced that the enamel is a vital and permeable membrane. Fischer and Mayerhofer[3] quoted from Boedecker, state that "the times in which the enamel of the teeth was considered as a dead structure of the animal organism are not far removed, and it was only after many extremely difficult researches that the vital energy of the adult enamel was proved. In itself the hardest of all animal tissues, possessing only about 3 per cent of organic matter, the enamel is so wonderfully constructed that we must admire the power of nature to make the organic matter, so economically distributed, serve in the process of metabolism. In a most ingenious manner the protoplasmic processes of the dentinal fibrils either enter or lie contiguous to the enamel. The enamel and dentin communicating with one another by means of a protoplasmic network probably maintain a nutritive metabolism, while sensation is limited to the dentin."

C. F. Boedecker[4] holds that the dark lines seen passing from the dentin thru the enamel to the surface are not artifacts resulting from the grinding of the specimen. He believes that they are really organic structures which are in connection with the dentinal fibers. To these he gives the name of lamellae. In conclusion he states that "interchange of substance within the enamel must necessarily depend upon the presence of organic channels. Whatever circulation does occur in the enamel, then, must take place thru the enamel lamellae." Boedecker also quotes H. Ganzer,[5] who stained the enamel by injecting coloring matter into the arterial system.

Bunting and Rickert[6] conclude that "from the evidence which we have gained, we are convinced that the enamel and the dentin of the teeth are, as a rule, more or less porous and that they will admit of a passage of salts and solvents both from the blood to the surface and from the saliva to the interior: that such flow take place in a variable and fluctuating manner due to changes in the composition of the blood and the saliva."

Underlying the enamel and the cementum, and surrounding the entire pulp cavity, except at the opening of the root-canal is the dentin, another type of calcified tissue. It is everywhere permeated by a system of canaliculi, the dentinal tubules or canals, which extend in a radial manner from the pulp cavity outward to the enamel or the cementum. Their course is a characteristically curved one, somewhat like the letter *S*. The cavity of the canals is partially occupied by the dentinal processes (fibers) of the odontoblasts, an arrangement which may be compared to that existing between the processes of the bone cells and the canaliculi of bone. At their inner extremity the tubules are from 2 to 4^{m} (micra) in diameter, but they taper very gradually, especially in the outer portion of their course, where they finally reach a diameter of no more than 0.5 to 0.1^{m} (micron).

The dentinal tubules may divide

[3]Ergebnisse der gesamten Zahnheilkunde, III (1910), 183.

[4]"Nutrition of the Enamel of the Human Teeth," Dental Cosmos, LIII, No. 9 (September, 1911), 1000.

[5]Anat. Anzeiger, XX, 28.

[6]"The Tooth, a Permeable Membrane," Jour. Nat. Dental Assoc., V, No. 5 (1918), 59.

dichotomously in the inner third of their course. Beyond this point they give off very fine lateral twigs, which at first leave the parent tubule nearly at right angles, but later are inclined toward the periphery. At their distal end most of the tubules divide into a group of terminal branches, some of the arborization being very extensive, others consisting of but two or three subdivisions. The coarse branches are frequently looped, the distal end of the loop often anastomosing with adjacent tubules. The walls of the tubules are formed by extremely dense calcareous sheaths which are very resistant to the action of acids.

The superficial portion of the dentin is formed by the granular layer of Tomes's, in which there are no dentinal tubules. Instead there are in this layer numerous small interglobular spaces from which minute canaliculi radiate in many directions. Many of these canaliculi are connected with the dentinal tubules, with the canaliculi and lacunae of the cementum and also with the inner layer of the enamel. This granular zone is relatively thick in the root of the tooth but becomes much thinner toward the crown.

As has been mentioned above there are numerous well-known investigators who maintain that this arrangement shows that there is a direct communication between the enamel and the dentin. Inasmuch as the dentinal tubules are in direct communication with the pulp cavity there must then be a possibility of a passage between the surface of the tooth and the pulp cavity.

In the cavity of the tooth is found the pulp, which consists of an embryonal type of connective tissue, rich in branched stellate cells but poor in fibers. It contains no elastic tissue and the delicate collagenous fibers, instead of forming bundles, are arranged in an interlacing network, the fine fibrils of which are in intimate relation with the connective tissue cells. The stellate cells are scattered thruout the entire pulp, but at the periphery of the pulp chamber are crowded closely and much enlarged. These peridental cells form the layer of odontoblasts which are in contact with the dentin.

The odontoblasts are cylindrical, branched connective tissue cells whose long axis is at right angles to the surface of the adjacent dentin. From the apex there extends into the dentinal canals a delicate process which frequently passes all the way thru the dentin. Lateral processes from the cell body interlace with each other and unite the cells into a membranous layer. Other processes are given off from the base of these cells and intermingle with the fibers of the pulp, so that if this tissue is forcibly separated from the dentin the odontoblasts come away with the pulp.

The dental pulp is richly supplied with blood vessels derived from a nutrient artery which enters thru the root-canal, its several branches forming a network of arterial and capillary vessels in the center of the pulp cavity. There is also a peripheral fine-meshed capillary network which is in close relation with the layer of odontoblasts.

A rich nerve supply is derived from delicate branches, which also enter by the root-canal. Many of the nerve fibers lose their myelin sheath soon after they enter the pulp and form a primary plexus in the connective tissue, from which they pass to the periphery and form a marginal plexus beneath the odontoblasts. Altho many claim that delicate sensory filaments ramify over the odontoblasts and pass into the dentinal tubules, such a belief has not been substantiated. The general impression at present is that the nerve fibers do not actually pass into the tubules.

For many years it was thought that

the pulp does not contain lymphatic vessels or spaces, but the work of Schweitzer[7] seems to prove conclusively that they are present. More recently Dewey and Noyes[8] substantiate the work done by Schweitzer and leave little doubt as to the presence of these structures.

In addition to the elements of the tooth itself, there is a very important tissue surrounding the tooth known generally as the peridental membrane, altho a more correct term is that of "alveolo-dental periosteum," as used by Hopewell-Smith. This so-called membrane is composed of dense fibrous connective tissue containing a rich supply of blood vessels, nerves, and lymphatics. These are derived from the apical vessels and nerves which give off numerous branches that extend upward into the membrane and anastomose with similar elements in the gum tissue.

Microscopic study of this body shows that the fibers are collected in a more or less definite arrangement. The horizontal group passes directly at right angles from the cemental portion of the tooth to the alveolar process. The union is a very firm one, the ends of the fibers being imbedded in the mass of lime salts. This group is found at the crest of the alveolar process. The fibers of the oblique group pass obliquely from the cementum to the alveolar bone. This group is found over the main body of the root of the tooth. The apical group is composed of those fibers which have their origin around the apex of the tooth and extend in fan-shaped bodies to the alveolar process.

In addition to the above-mentioned groups there is usually a large amount of dense connective tissue in which the fibers run almost parallel with the length of the tooth. These act largely as the supporting tissue of the blood vessels and nerves.

As the individual becomes older, the peridental membrane becomes much thinner and the parallel fibers may almost entirely disappear. This membrane is a very important one as it is the means by which the teeth are attached to the jaw, the different fibers playing certain parts. The apical group is the thickest and acts as a cushion to support the pressure in mastication. It also supplies nutrition to the cementum, and if it in any way becomes separated the cementum will undergo degenerative changes as it does not possess any other blood supply.

It is this peridental membrane which plays a very important part in the histology of the granuloma and which helps largely in explaining the reasons for the changes that occur. An interesting anatomical finding is the frequent presence of small masses of squamous epithelium which bear an important relationship to the formation of apical cysts.

As has been stated already, the granulomas are the result of a chronic or subacute infectious process. Consequently the path by which the infecting agent can get to the apex must be considered carefully. Primarily the condition follows caries. Altho it is questionable whether the permeability of the enamel, provided that it is permeable, would allow organisms to pass thru there is room for belief that the dentinal tubules might afford passage. As the caries advance into the dentin the diameter of the tubules increases and the possibility of bacteria passing thru becomes more and more probable. Before the organisms gain entrance to the pulp cavity there have been various circulatory disturbances taking place within. The earliest condition is probably that of hyperemia, and, if that continues, there will ultimately be some degenera-

[7]Arch. f. Anat. u. Entwickel. LXIX (1907), 807, LXXIV (1909), 927.

[8]Dental Cosmos, LIX (1917), 436.

tive changes taking place in the pulp itself. Such a tissue will have less resisting power than the normal, and when infection does result the process will tend to extend rapidly. The pulp will eventually die and the infecting organism tend to pass in all directions. It naturally will pass sooner or later to and thru the foramina of the canal and there come in contact with the peridental membrane. The impression gained from a study of over a hundred teeth from which the granulomas were obtained is that the infection passed from within the tooth. Theoretically it might pass from the gingival border along the peridental membrane to the apex of the tooth and set up a chronic inflammation. The microscopic findings, however, do not support this idea. All the evidence so far found is opposed to that method of extension.

As the histologic changes are those of a subacute inflammation, the cause must be looked for in an organism of comparatively low virulence. The results of many examinations by many men show that the bacteria most commonly found are the streptococci of the viridans type. Infections by this organism in other parts of the body are characterized by the large number of plasma cells and lymphocytes and the absence of the ordinary polymorphonuclear leucocyte, giving rise to a picture similar to that of the dental granuloma. In the examination of the specimens on which this article is based a very interesting condition was noted. In the majority of the pulp cavities the streptothrix buccalis or a very similar variety of organism was found. In quite a number it was present at the external opening of the canal and in five instances it was imbedded within the granuloma, separate from the tooth. Just what part this organism may play is not clear but it is a well-established fact that certain forms of streptothrix are pathogenic and can give rise to inflammatory conditions in the mouth. The difficulty in determining their activities is due to the present inability to cultivate them artificially. There are but two investigators who claim to have grown the streptothrix buccalis and as their work was done about 1886 it is open to many criticisms.

Whatever the infecting organisms may be we find certain very definite changes taking place. When an inflammation starts we primarily have alterations in the circulation, followed by degenerative processes of varying degree. At first the pulp in the neighborhood of the caries will be involved, but the conditions extend until the external opening of the dental canal is reached. Covering the apex is the peridental membrane which is pierced for the passage of the vessels and nerves supplying the pulp. This membrane, being very dense, offers considerable resistance to the passage of the infection, and it is here that the first step in the formation of a granuloma is seen. As in all inflammations, there is an escape of fluid, exudate, from the vessels into the surrounding tissue. This naturally tends to separate the connective tissue membrane covering the tooth from its attachments. At the same time the presence of the increased fluid makes it easier for the cells to escape from the blood into the enlarged spaces. These two processes together play an important part as various antibodies are present in the fluid and in certain of the cells the polymorphonuclear leucocytes are various ferments. The common rule, however, is that the plasma cells predominate. These cells, which are characteristic of subacute and chronic inflammations, are obviously derived from the lymphocyte thru a modification of its nucleus and protoplasm. These cells are rather larger than lymphocytes, somewhat ameboid,

but in fixed preparations they usually are of a rounded or oval form, with the nucleus eccentrically placed, generally at one end of the cell. The nucleus, whose chromatin is in coarse masses, is surrounded by a pale halo, while the protoplasm takes a blush stain with the usual methods. Such cells are conspicuous because they are so constant in their form. They are not commonly phagocytic but probably produce a digestive ferment.

As the process continues we find certain very definite conditions appearing. As a result of the distension of the interspaces in the connective tissue, the plasma cells will be found in strands and in masses. At the same time these cells will tend to collect in a well-defined mass between the slightly elevated peridental membrane and the tooth. These cell collections, however, are not such as we find in abscess formation. On account of the long continued irritation of the peridental membrane, there takes place a multiplication of the fixed connective tissue cells. The fibrillary processes of these new cells ramify in all directions and form a fine network, the spaces of which are filled with plasma cells. At the same time there has been a proliferation of the endothelial cells of the pre-existing capillaries. These buds tend to penetrate everywhere into the newly forming connective tissue, unite and give rise to new capillaries and arterioles. In this way very typical granulation tissue is formed. In some instances the formation of new vessels has been so great as to present areas that are distinctly angiomatous. In the great majority of the hundred or more granulomas examined some polymorphonuclear leucocytes were present, but as a rule they were few in number.

Surrounding the cellular area there was in every case a more or less well-defined zone of adult fibrous tissue. In every specimen which was attached to the tooth, there was no difficulty in tracing the continuation of the granuloma capsule with the peridental membrane. The appearance of this zone varied considerably; it might be quite broad and greatly infiltrated by plasma cells or it might be very narrow and form cells, the latter giving the impression of being much compressed. Now and then a specimen is seen in which there seems to be a distinct rupture in the capsule, but as this may have occurred during the extraction of the tooth no deductions can be drawn.

In addition to the carious types of cells present in the cellular area certain peculiar bodies are found in varying number, occasionally very few, again a great many. These bodies lie mostly extracellularly, are perfectly round as a rule, and vary greatly in size from a minute droplet to others as large or larger than a red blood corpuscle. They may occur singly, in groups of three or four, or in masses of a dozen or so. With all the methods used they showed a marked affinity for the acid element in the stain, coloring red with eosin and acid fuchsin, straw yellow with picrocarmin, and purple when the Gram-Weigert method was employed. They are probably the so-called "Russell's bodies" which are quite frequently found in cancer and at one time were thought to be a form of parasite giving rise to that disease. They are, however, commonly found in chronic inflammatory conditions and probably are the products of cellular degenerations. Whether examples of hyaline degeneration or of albuminous matter is still unsettled.

The above description is that of the simple granuloma in the early stages, but there evidently are very important changes occurring later. In many of the specimens there is found a quite

definite area, usually near the center of the granuloma, in which no fibrillar structure can be observed. Examination under the high power shows that probably the majority of the cells present are polymorphonuclear leucocytes. Many plasma cells, as well as the large bubble-like nuclei of the connective tissue cells, are found. The general impression is that such an area represents the beginning of an abscess. In all of them, however, the main structure is that of a granuloma that is undergoing a secondary infection, with degeneration of the tissues. Associated with the leucocytic infiltration is an increase of exudate. As a result of the breaking down of the polynuclears and the plasma cells, ferments of various sorts are set free and the various cells are in turn broken down. There is then formed an area of degenerated tissues which must in some way be taken care of. The end results in this area will depend very largely upon the conditions that brought about the degenerative changes. In several specimens, minute particles of broken-down bone were present. Surrounding these fragments were great numbers of leucocytes that probably were assisting both in the breaking down of the bone and in its disposal. Until such particles were done away with completely there could be no quieting down of the process. If no foreign body were present further changes might readily take place.

Whenever there is an area of destroyed tissue, it will be found that the body attempts to remedy the condition. The first part to be absorbed is the exudate. This is taken up mainly by the lymphatics. The fragments of the cells will be carried off by leucocytes and the beginning of an area free from formed tissue takes place, the so-called lumen. It may be that this space fills with pus, a true abscess forming. Instead of that the contents may be fluid, thus forming a true cyst, or the cavity may be filled with the material resulting from the degeneration of the various kinds of cells.

One of the most interesting features in the examination of these lesions is the presence of squamous epithelium. In approximately 30 per cent of the granulomas there was found epithelium in greater or less amount. It seemed quite commonly to be found close to the tooth more or less closely associated with the peridental membrane. The majority of observers believe that these cells have their origin in the embryonal rests, or remnants, of the primary enamel organ, such as are frequently found in the peridental membrane itself. Such a belief would seem to be a very reasonable one, as in the development of the enamel there is every opportunity for portions of the outer epithelial layer of the enamel organ to become detached and lie dormant for many years. As long as there is no irritation they will remain quiescent indefinitely. If, however, an infection occurs there is then a reaction on the part of all the cells, each one attempting to carry out its particular function. As the chief property of squamous epithelium is to act as a protective covering we will find that the isolated cell nests undergo proliferation and tend to infiltrate the surrounding tissues. In the course of time there may occur a breaking down of a portion of the granuloma with subsequent absorption and the formation of a cavity, the lumen. Naturally, when the epithelium penetrates this far its tendency is to spread along the surface and thus form a lining to the cavity. This may consist of but a narrow layer of epithelium or of a thick band following all the irregularities of the surface. Altho these cells do not form keratin there is a constant proliferation of the cells and those in intimate contact with the cyst contents will tend to degenerate and desquamate.

Such broken-down cells will be found in varying amounts within the cyst cavity. As the contents of the cyst increase it gradually becomes larger and larger and as a rule the wall becomes thinner. The process, however, frequently becomes quiescent and the cyst remains without giving rise to any further local or general disturbances.

In order that this abnormal formation shall enlarge it becomes necessary for the cancellous bony structure of the jaw to disappear. At first it may seem strange that a soft, and frequently cystic, mass should have any effect upon so dense a tissue as bone. An interesting and similar process on a much larger scale takes place quite commonly in aneurysms of the aorta. As this vessel enlarges it may press upon the spinal canal. Altho the degree of change is much less, the process of the bone absorption is essentially the same. In addition to the circulatory disturbances, the absorption takes place as a result of the activities of certain large cells commonly found in the neighborhood of blood vessels. These cells are known as osteoclasts and are derived from the connective tissues. An examination of the bone undergoing destruction will show hollow spaces or indentations, known as Howship's lacunae, in which will be found the osteoclasts. As long as the granuloma tends to increase in size, the absorption of the bone will continue, but when the inflammatory reaction subsides there is no further destruction. It is on account of the destruction of the bone and its replacement by soft tissue that the characteristic picture of the roentgenogram results. On account of the decreased resistance to the passage of the rays they cause a greater effect upon the sensitized film with the production of the so-called "shadow." Altho the presence of such an area can generally be demonstrated, the X-ray gives but little information as to the activity of the process.

In addition to the changes that take place in the soft tissues it will be found that the tooth structure itself shows, as a rule, very well-marked abnormal conditions. The first noted is an overproduction of cementum, hypercementosis. This is generally most conspicuous near the apex and may be very extensive. Inasmuch as the peridental membrane is the nutrient and osteogenetic tissue, the overgrowth of cementum must in some way be connected with stimulation of that structure. As the inflammatory reaction is of a subacute and chronic type, it is characterized primarily by an increased activity of the specialized cells. The function of the cells in contact with the tooth is to form cementum and consequently they proceed to lay down that tissue. In the course of time the exudate of fluid and the cellular infiltration tend to separate the membrane from the tooth and the activities cease.

Practically always present in the areas of hypercementosis are places in which the abnormal tissue is undergoing dissolution. Small depressions, the Howship lacunae, are present, and larger areas as well, in which the absorption has passed thru the thickened cementum into the dentin. In some instances the absorption had extended almost to the pulp. The method of breaking down of this tissue is not clear. Certain large cells containing many nuclei and known as osteoclasts are supposed to be the chief factor concerned but the matter is by no means settled. The most recent investigations tend to show that the osteoclast is not as active physiological structure but is a degenerating cell composed of osteoblasts which have fused to form multinucleated masses. In many of the specimens there has been very extensive

destruction of the root portion, a large portion of the apex having been absorbed.

Summary

From this study of something over a hundred specimens of granuloma the following deductions have been made:

Altho there is some dispute as to the advisability of referring to these abnormal masses as granulomas, that name is a convenient one and is comparatively accurate. It should be remembered that it is by no means easy to draw a sharp line between a true tumor and a mass of granulation tissue. One point, however, is certain, that is, that they should not be called abscesses as the purulent condition found in some is evidently a secondary process grafted upon the chronic inflammation with its plasma cell infiltration. Primarily the polymorphonuclear leucocyte does not occur, but in certain instances, where there is a spicule of necrotic bone or where there has been a subsequent invasion by an active pyogenic organism, the pus cell may be present in large numbers and eventually form an abscess. As in many of the specimens there were cavities extending into the pulp chamber, there would be no difficulty for bacteria of many kinds passing down the cavity to the granuloma.

In the formation of the lesion it is interesting to note how, in every case in which the attachment to the tooth was shown, the capsule of the granuloma was found to be continuous with the peridental membrane. The general effect was that of distinct capsule formation and gave the impression that it was a distinct effort on the part of nature to wall off the infection so that it could not extend to other parts of the body. Just how efficient such a walling-off might be, is difficult to say; at present there is not sufficient data from which to draw conclusions, yet it gives the impression of being a distinctly protective reaction.

Another line of defense is seen in the epithelial lining that is present in the cysts. As is well known, the squamous cell type is particularly adapted to its function of acting as a barrier to the passage of infection. The more complete the lining the less the danger of infection, particularly after the process has subsided. This protective coat on the inside and the connective tissue capsule on the outside should prove a very effective barrier. The danger, however, of leaving such a lesion is that no one can tell whether or not the line of defense may be suddenly broken and systemic infection occur. A study of granulomas of long standing should be of much value.

Conclusions

1. That granulomas are specifically subacute or chronic inflammatory lesions characterized by plasma cell infiltration and connective tissue formation.

2. That the term "abscess" should not be applied except in those cases in which the symptoms are acute and purulent infiltration is present.

3. That the capsule formation, which is continuous with the peridental membrane is a protective reaction.

4. That the epithelial lining of the cysts is also a protective reaction.

5. That the epithelial cells present in the above are derived from the remnants (embryonal rests) of the outer layer of the enamel organ, which are so frequently found in the peridental membrane.

THE PREVENTION OF CHRONIC ORAL INFECTIONS

By ARTHUR D. BLACK, A.M., M.D., D.D.S., F.A.C.S., Chicago, Illinois

(Read before the National Dental Association, New Orleans, October, 1919)

AVAILABLE statistics[1] show that 78% of persons over 20 years of age have suppurative destructions of portions of the maxillary bones, either along the sides of the roots of the teeth or about their apices. These lesions present a definite menace to health and demand the most serious thought of the profession both as to means of eradication and methods of prevention. Since a high percentage can be eliminated only by the extraction of teeth, the importance of finding means of prevention is quite evident.

Success in prevention is dependent upon the most intimate knowledge of etiology and pathology. It is also important that the unfavorable prognosis of a particular condition or disease be thoroly understood as this becomes an essential factor in the attitude of each practitioner and patient towards preventive treatment. A disease which has a very low mortality and from which a good recovery is practically certain, is of little interest from the standpoint of prevention. The milder diseases of childhood, for example, give no concern. Research workers have naturally devoted their attention to diseases which frequently cause death, in the hope that preventive or abortive measures might be discovered. The more unfavorable the prognosis, the greater the demand for prevention.

Even for diseases with high mortality there has been great difficulty in persuading people to accept well-established methods of preventive treatment. With the almost perfect record of vaccination against smallpox, it would seem that all persons would desire this simple treatment, yet there is scarcely a community in which resort to the courts has not been necessary to enforce vaccination as a measure of public protection. The psychology of this is simple. Most individuals are not interested in preventive measures so long as they are well. They must either be actually sick or seriously threatened, as by an epidemic, before they seek medical service. Health preparedness has been as far from the minds of most of our people as war preparedness. The great war has taught us something of what might have been accomplished by Roosevelt's doctrine of military preparedness as a means of maintaining peace; it has also taught our people much of the value of preventive medicine as a means of preserving health. The protection of our soldiers against typhoid fever was one of the wonderful achievements of the war. In our little army in the war with Spain about 13,000 men died of typhoid, while our army of millions in the great European conflict lost but 163 men from this disease up to March, 1919. The lesson of preventive medicine has been carried home to every city, village and rural community; to almost every household. It should be one of the great benefits to come out of the war that we shall consult the doctor while we are well in order to keep well. May not the dental profes-

[1] *Jour. Amer. Med. Assoc.*, LXXI (1918), 1278.

sion each year persuade an ever increasing number of our people to consult the dentist at regular intervals in order to preserve healthy mouths?

The mouth is related to the general health, both by its maintenance as a good machine to properly masticate food and by the menace of infection about the teeth. The value of the teeth in mastication and the menace of mouth infection must often be weighed one against the other, as the clearing of the mouth of infection very frequently means impairment of masticatory power. In a critical examination of 6000 roentgenographic films of the mouths of 600 persons over 20 years of age (the average age being 35) 55% were found to have one or more rarefied areas about the apices of the teeth, with an average of 1.4 areas per person. In this same group, 53% were found to have one or more areas of bone destroyed along the sides of roots, with an average of five such areas per person. While many had both apical and lateral infections, there were also many presenting one type and not the other; the number of the 600 persons shown by roentgenograms to have one or the other or both—to have definite suppurative destruction of the maxillary bones being 78%.

At first thought it seems almost unreasonable that the percentage should be so high. In this connection, attention is called to the statement by Dr. Frank Billings in his "Lane Lectures" on focal infections, that the large majority of persons, especially those living in large cities, have been at some time infected with tuberculosis, but that the lesions have generally healed, so that only a comparatively small number really suffer from this disease or know that they have been so infected. It is true that most infections are overcome by tissue reactions and are thus eliminated. Unfortunately, this is not true of the chronic mouth infections. If we knew nothing of the pathology of these mouth lesions, clinical observation and roentgenographic examinations should have convinced us that they are practically universally chronic. The average tubercular infection is less of a menace to health than the chronic alveolar abscess or the pus pocket, because it is likely to heal and the mouth lesions cannot heal.

It is the intention to present a brief review of the etiology and pathology of the two types of chronic mouth infections, as we wish primarily to establish the fact that the pathological changes in the tissues practically preclude the possibility of healing.

Recent investigations by Dr. F. B. Noyes[2] of the lymphatics of the peridental membrane have furnished an important link in the pathological changes which take place. Dr. Noyes demonstrated chains of lymphatics attached to the sheaths of the blood vessels in the peridental membrane, and since the lymphatics are known to be carriers of infection, it is only necessary to call attention to the fact that the direction of the larger blood vessels in the peridental membrane is parallel to the long axis of the root, and that the movement of lymph is from the gingivae toward the apex of the root, in order to recognize a natural route of travel for infection involving the gingivae.

We may summarize the pathological changes in cases of chronic suppurative pericementitis as follows: First, there is an irritation of the gingivae, usually long continued or often repeated, which makes possible the invasion of this tissue by micro-organisms commonly present in the mouth. In considering the infections of the gingivae, especially by organisms of low virulence which cause chronic infections, the peculiar structure of the gingivae must be remembered. This tissue is extremely well adapted to resist infection, both on account of the compactness of the epithelial cells, and because of its excellent blood supply, and it often will withstand constant or oft-

[2] *Jour. Amer. Med. Assoc.*, LXXI (1918), 1179.

repeated irritation for months or even years without serious invasion by infection. Doubtless the general condition of the health, the age, etc., of the individual have a direct bearing upon the resistance of the gingivae. Because of the fact that peridental disease in no case appears to begin elsewhere than in the gingivae, must we conclude that the whole question of local and systemic causes of chronic pericementitis really becomes a question of the effect of either the local irritation or the systemic condition, or both, upon the resistance of the gingivae to infection. When in reasonably normal condition, the gingivae will successfully resist invasion by those organisms which cause chronic infections. Only as a result of long continued or often repeated punishment, or of systemic derangement, do the gingivae become seriously involved. It is this quality of resistance of the gingivae, constituting its most important function of protection to the peridental membrane which gives the dental profession the opportunitv to apply preventive treatment successfully.

Infection being established within the gingivae, it gradually involves more or less tissue, as the balance of virulence of infection and tissue resistance varies. The minute lymphatics take up a share of the infection and it is carried with the movement of the lymph along the perivascular lymphatics, which are attached to the walls of the vessels coursing thru the peridental membrane, towards the apex of the root. The effect of the infection within these lymph vessels is two-fold; there is a thickening of the walls of the blood vessels which are surrounded by the infection, also an accumulation of round cells from the neighboring tissue to wall off the infection. Eventually the peridental membrane immediately surrounding the blood vessel will be destroyed for a little space. Fibres are cut leaving a portion attached to the cementum and a portion attached to the bone of the socket. If the same process is going on about a number of blood vessels running parallel to each other, there eventually occurs a definite break—a pocket—in the peridental membrane. At the time, the cementum is covered by short ends of fibres, but owing to the fact that the blood supply is largely cut off, and also to the exposure of this connective tissue to infection, these soon die, leaving the cementum denuded.

The ends of the fibres of the peridental membrane attached to the bone of the alveolar process gradually disappear, as does the corresponding area of bone. The destruction of this tissue—both the fibres and the bone—is likely a combined pathological and physiological process; the infective process doubtless plays a part, yet it must be remembered that there would be a physiological absorption, corresponding to that which takes place following the extraction of a tooth. So far as the area involved is concerned, the break in the peridental membrane should have the same effect as the extraction of the tooth. Thus the overlying bone and soft connective tissue gradually is changed to one that varies from a connective tissue of ordinary type to a highly inflamed granulation tissue, the blood vessels of which have thin walls, easily penetrated by micro-organisms. Finally we turn to the denuded cementum, now a dead tissue, because the cementoblasts which maintained its vitality have been destroyed. The cementum, being a porous tissue, has absorbed the products of the suppurative process.

So far as our present knowledge goes, a chronic alveolar abscess becomes established only as a sequela to the death of the pulp of the tooth. The etiology is far from clear. The opportunity for infection of the periapical tissue by continuity from a dead pulp is recognized. There are many other probable causes, such as injury to the periapical tissue by broaches or root-filling materials passed thru the apical foramen, or by medicaments which seep thru. Careful studies of these conditions are needed. We may say, however, that infection of the peri-

apical tissue occurs either directly from a dead pulp or secondarily via the circulation or lymph channels, following irritation of this tissue; or thru the root-canal after the pulp has been removed in cases in which the cavity in the tooth is left unsealed. Dr. Thomas L. Gilmer[3] was first to report upon the bacteriology of chronic alveolar abscess, the infecting organisms being almost universally a streptococcus veridans or hemoliticcus.

Infection being established in the apical region, the tissue changes correspond closely to those which take place in the formation of pockets along the sides of the roots. There is destruction of the peridental membrane and of the adjacent bone of the alveolar process, the cementum is denuded and becomes pus soaked. The physiological tendency so far as the bone is concerned, is opposite to that in cases of pus pockets. As has been mentioned, with the destruction of the peridental membrane along the side of the root, the physiological tendency is for the overlying bone to be absorbed. About the apex, the tendency is for the bone which has been destroyed by infection to be rebuilt. The severing of the peridental membrane in this region by the extraction of the tooth is followed by a filling in with bone of the deeper portion of the socket, not by an absorption such as occurs at the crest of the process.

The denuded cementum is the tissue of primary concern in both types of infection. There is no reason to expect a reattachment of the overlying soft tissue to the root under any circumstances. Not only have those tissue elements necessary to a normal reattachment been destroyed, but the pus-soaked condition of the cementum precludes the possibility of attachment such as occurs when teeth are replanted.

In a case of replantation there is an attachment of the tissues to the surface of the root, not by the formation of a peridental membrane, but by a process in connection with which there is absorption of the root; the absorption continuing until the tooth becomes loose and must be removed. If a tooth to be implanted is immersed in almost any antiseptic solution, there will occur no attachment, because the cementum will have absorbed enough of the antiseptic to have made that root non-chemotactic to the surrounding tissue. It repels the soft tissue cells instead of attracting them. The pus-soaked cementum does the same.[4]

Let us recall the fact that the cementum is a passive tissue; it has no circulation of blood and cannot therefore separate and throw off a portion of itself as occurs in necrosis of bone. The dead cementum therefore remains a constant irritant to the surrounding tissue. The peculiar nature of the cementum accounts for the universal chronicity of this type of infection; it also accounts for the high percentage of both forms of chronic mouth infections as demonstrated by roentgenographic studies—the lesions are permanent lesions. This must be clearly recognized by the dental profession before it will have a rational basis of procedure in the management of these infections or before it will take proper interest in preventive measures.

In the application of successful preventive treatment, it is necessary that we consider those conditions which have to do with the establishment of the first pathological changes. We have noted that a gingivitis always precedes the formation of a pus pocket. Our attention therefore must be directed towards the gingivitis. Here again it is essential that we not only recognize the relationship of the gingivitis to the deeper lesion, but also the high incidence of inflammations of the gingivae. Carefully collected statistics[5] show that 95% of adults have one or more areas of gingivitis and the large majority of these may be considered

[3] *Jour. Amer. Med. Assoc.*, LXIII (1914), 2023.

[4] G. V. Black, *Special Dental Pathology*, p. 149.

[5] *Dental Summary*, XXXIX (1919), 743.

forerunners of serious peridental disease. The dentist must realize that nineteen out of every twenty adults who present for examination require treatment for gingivitis and that less than half of the inflamed areas are due to deposits of either salivary or serumal calculus. Therefore other operations than scaling and cleaning the teeth are necessary in the mouths of more than half of our patients solely for the treatment of areas of gingivitis. It must come to be a part of the mouth examination that these areas shall be recorded and then treated with even greater seriousness than cavities in the teeth. In the light of present knowledge there should not be a place in the dental profession for the man who pays attention only to reparative procedures made necessary by caries.

It is clearly our duty to seek the cause of each area of inflammation and to do whatever may be required to remove that cause. The procedures are usually simple. The most serious lesions are due to the wedging of food between the teeth because of faulty contacts. Conditions vary greatly; teeth may have separated slightly following the extraction of a neighboring tooth, a previously placed filling or crown may not have been built to proper contour; there may be irregularity of the teeth, or there may be a rough margin of a filling or crown. It is usually easy to determine the cause and it generally requires a simple operation to correct it. The patient must be impressed with the fact that the care of the gums is one of the prime essentials of both mouth health and general health, and the dentist must recognize the imperative demand for treatment during the stage of gingivitis; that after the peridental membrane is broken, future treatment is palliative, not preventive. This preventive treatment devolves upon the general practitioner, not upon the specialist in the treatment of peridental disease.

Success in preventing chronic alveolar abscesses is primarily a question of pulp conservation. With the present lack of education of most of our people, and lack of proper systematic and sufficiently frequent examinations by dentists, we cannot hope to do more than make slow progress in pulp conservation. We should not relax in our efforts to educate the public and to improve our patient management, but it will remain the fact that but a small percentage of persons will reach adult life without the loss of one or more pulps. In this paper we will direct our attention to the prevention of chronic abscesses in cases in which pulps are involved.

In this connection, I am impressed with the fact that we have not made much progress in pulp treatment during the past few years. With few exceptions, articles appearing in our journals today are not materially different from those of five years ago and most writers are expressing opinions which are without foundation of fact. We do not know definitely just what is causing the high percentage of chronic alveolar abscesses. I shall endeavor to state certain rules which seem to me to be safest to follow in the light of present knowledge, and at the same time suggest a plan for determining what methods are best.

First of all it is imperative that we keep an accurate record of each case. This should include: first, a diagnosis; second, a memorandum of every treatment; third, the condition of the root filling as shown by roentgenograph; and fourth, the condition after an elapsed period of a year or more.

For the diagnosis we should differentiate between vital pulps, dead pulps without abscess formation, teeth with previous root fillings which are to be replaced, and teeth already abscessed. To do this it is necessary that a roentgenograph be made for each tooth to be treated, except those having vital pulps. This is of the utmost importance, otherwise future records are worthless for all those cases which show destruction of periapical tissue.

If the pulp is vital and it is to be destroyed, we have a choice of several methods of procedure; pressure anesthesia, novocain, infiltration, or arsenic being most commonly used. While many condemn each of these methods, particularly the use of arsenic, there is no definite proof that either method is harmful. Investigations now in progress, but too limited as yet, tend to show that arsenic may be safe to use. However, until we have the facts I would prefer not to use an agent so definitely destructive to soft tissue.

Asepsis, which requires the application of the rubber-dam for every treatment, the sterilization of the immediate field and of everything which goes into the pulp chamber and root-canal, is imperative. Probably more dentists are derelict in their duty in asepsis than in any other thing in pulp treatment, and infection carried into root-canals by dentists doubtless causes a considerable percentage of abscesses.

In removing the pulp, one should have the best possible access, sacrificing whatever may be necessary of the crown of the tooth to insure the most thoro technic within the canals. The greatest care should be exercised not to injure the periapical tissues by passing broaches thru the apex. Hand instruments should be used and the engine discarded after the canals are entered.

The drugs to be used in treatment present a very unsettled problem. Until we have definite knowledge, the only safe rule to follow is to omit the use of any medicament which would injure soft tissue by contact, thus being certain to avoid damage to the periapical tissues. The clinical evidence before us today relative to the value of several agents is practically worthless, because it lacks substantiation by proper case histories in sufficient number.

There is much discussion of root-filling materials. We have sufficient roentgenographic evidence that the large majority of roots may be well filled with gutta-percha alone, or in combination with one of several plastic materials. The difficulty is not so much with the method of root filling as with the preparation of the canal. More time must be devoted to the painstaking task of removing the last possible vestige of pulp tissue and to the enlargement of the smaller canals.

The case history—an accurate record of the diagnosis, of every step in treatment, and the final checking with roentgenographs taken after a year or more has elapsed—must form the basis of accurate knowledge and future progress in pulp and root-canal treatment.

The time has arrived when each practitioner of dentistry must ask himself if he is doing his full duty to those for whom he renders service. He must realize to what extent health and prolongation of life are related to his care of the mouth. He must ask his own conscience if it is right to treat root-canals without the rubber-dam, to use unsterile broaches in canals, to leave pulp chambers and root-canals open, permitting infection to enter, to disregard inflammations of the gingivae, to fail to restore proper proximal contacts which will protect the gingivae, to place crowns so made or fitted that they cannot fail to irritate the soft tissues, to do many things which are today plainly contrary to the best teachings; things which have been fully discussed before our societies, but are still sorely neglected in the practice of many. Such men are not measuring up to the demands of the time. We need today a closer study and application of the facts at hand, rather than new knowledge which might be gained by research.

THE PROBLEM OF FOCAL INFECTION

By JOHN V. CONZETT, D.D.S., Dubuque, Iowa

(Read before the Chicago Dental Society, February 15, 1921)

A SCORE of years ago, or less, it was thought necessary for the dentist to apologize for his profession and take a decidedly second place in the aristocracy of medicine. Today we find that this has changed. Even tho there are a few men in the profession who seem to be ashamed of it, and attempt to ally themselves with the older branch of the healing art, the vast majority of the dental men are candidly dentists and are proud of it and would not change places with the greatest physician in existence. This is not in any way to the disparagement of the noble profession of medicine; for what profession has been more self-sacrificing and more genuinely philanthropic than that of medicine! Without the sacrifices of the great investigators of the past and the present, the world would still be in the grip of small pox, diphtheria, yellow fever, malaria, typhoid, and countless other diseases which have either been conquered or so attenuated that their onset is considered a slight thing in comparison with the dread they incurred in the past. In view of the heroic service which medicine has given to humanity, it does not become any of us to belittle it in any degree and any thought of it is foreign to the purpose of this paper. I do want, however, to impress upon the average dentist the nobility and importance of his profession.

Today we stand on a par with the other branches of the healing art, and by reason of the importance given to dental diseases as the progenitors of systemic diseases of greater or lesser severity, dentistry has risen to the position of the most important specialty of medicine.

The crisis which was instituted by the work of Hunter several years ago, and taken up by many of the medical men since then, has impressed many men of our profession with the thought that the very foundations of dentistry were threatened, and they would have been threatened if the policy of the radicals in both professions had prevailed.

But we must remember that the man of a single-track brain is always a radical; he sees but one thing at a time and has not the ability to properly correlate the many branches of science that have a bearing upon the question at hand. Therefore he is impressed with the thought that the particular branch of truth with which he is engaged is the whole universe, when the fact is that he is simply engaged upon a microcosm. So it is with the problem of focal infection. Introduced as it was by a scientific man earnestly seeking the truth and the benefit of humanity, it was eagerly taken up by men of his profession; because there was truth in the theory, its possibilities were overestimated. Thus the dental organs were given a dignity in the etiology of disease that was far beyond the truth. Many men in the profession were captivated by the fad, and a genuine hysteria resulted that threatened to make this generation toothless. Happily, there was a sufficient number

of men in the dental profession that had practiced their art long enough to know the absurdity of the position taken by the extremists, and their steadying influence prevented a panic among the profession and among the people at large. We have reached the time when scientists of a higher vision are deprecating the wholesale loss of teeth and are advocating a safer and saner dentistry.

If this were not true, dentistry would have gone back a century in its development, for if all pulpless teeth were to be extracted and all teeth affected by pyorrhea had gone the same route, it would have relegated the sciences of the profession to the dump heap. Of what use would have been the study of pathology if we were to extract all diseased teeth? Where would be the sciences of materia medica if there were no diseased teeth tolerated in the mouth to treat? Of what use would be the study of any of the dental sciences if we were to be nothing but stoppers of small cavities and restorers by some mechanical appliance of teeth that were lost? We would then have become a mechanical trade indeed, and the wonderful development of the past would be a forgotten dream.

The very contrary has been the fact; for the impress made by the dental profession upon the mind of the public by very reason of the importance placed upon us by the theory of focal infection has invested us with an importance that has raised us to our present proud position. But the time has come for the profession to definitely adopt a position upon the question that will be authoritative and positive.

I have no criticism to make of the good men of the medical profession for the position which they have taken. We must remember that they see the problem from the vantage point of the sick room. When a patient presents to the physician, he is in need of medical attention. As a result, when the theory of focal infection was brought to his attention and he began to examine the teeth of his patients thru the medium of the radiograph, he was instantly impressed with the great number of translucent areas about the apices of the teeth. Upon the removal of these areas in many cases the patient showed decided evidence of improvement. And as the laboratory strengthened the physician's views by finding the same organisms in the pathological areas that were found in the areas about the teeth, he was reinforced in his position and became more radical than his dental brother, for he saw the problem from a decidedly different angle.

The dentist that has had any extended experience knows that there are innumerable areas of translucency about the apices of the teeth of his patients, and he also knows that that has always been the case, and he further knows that little or no discomfort, immediate or remote, has been caused by such conditions in the vast majority of cases. He knows too that cases of infection among his patients are proportionally rare and that while there is an apparent improvement as a result of the extraction of a diseased tooth, it is often temporary. There have been too many cases where teeth have been sacrificed with no benefit to the patient.

Let it not be understood that we believe in the retention of diseased teeth. If any good has emanated from the present question, it is the truth that has been forced upon us—that we have retained too many teeth in the denture that should have been extracted—and the profession is under a debt of gratitude to those men. While many of our patients have lived in health in spite of such conditions in the mouth, it is due to their resistance and not to our ability. Therefore in the discussion of the problem let us first clear the atmosphere by acknowledging the fact that diseased teeth have no place in the mouth. Teeth that are diseased must either be removed or placed in a condition of health.

At the outset I wish to make two statements and support them with all the force that I possess.

First, I want to protest against the practice of certain physicians in diagnosing a dental condition either from radiographs taken by themselves or from those taken by radiographers, lay or professional, and then sending the patient to an exodontist with instructions for extraction. I want to protest against the exodontist removing teeth under such circumstances. I would make it a branch of ethics on the part of the extractor, with penalty of ostracism from professional courtesies, if he persisted in this pernicious practice, for in many cases he extracts the teeth indicated by the physician without any thought of the value of the tooth, or whether it is in a condition of disease or of health. I would make it a rule to demand that no tooth should be removed from any patient's mouth without a certificate from a reputable dentist. What would the physician think if we were to diagnose a case of appendicitis and send the case to the surgeon and he would operate and remove the organ without any attempt at diagnosis himself?

Second, I want to protest against the extraction of all pulpless teeth and to express the hope that the profession will take a definite stand upon that ground, for the idea is growing in some quarters as a result of the work of some physicians and some misguided dentists. The great reason for the second statement is the fact that many of the younger men of the profession have become so frightened over the legal possibilities of the situation that they are afraid to attempt a root-canal operation. An honest man is between the Scylla of saving the teeth and causing systemic infections and the Charybdis of robbing his patient of the entire masticatory apparatus with all of its attendant evils.

Clinical evidence is absolutely misleading in this or any other medical problem for we will be able to collect as many cases in support of one phase of the subject as of the other. I have no doubt that many of the men could, on the spur of the moment, cite cases that have occurred in their experience in support of either side of the question, and in accordance with their predisposition will be the preponderance of the cases cited. This is not to imply in the slightest degree that the men are not honest in their opinions, but the human mind is so constituted that it sees at first glance the evidence that supports an opinion and is blind to the contrary evidence. In support of this assertion let me briefly cite three cases.

The first, Mr. R., an Irishman of about fifty years of age, farmer in good health and rugged constitution before the present onset, consulted me about a small swelling in the region of the right lower third molar. I told him that I thought that it was due to an unerupted tooth. He said that that could not be true as all of his molars had been out for years. I took a radiograph and found, as I expected, an unerupted third molar that had penetrated the alveolis, but was held down by a dense fibrous tissue under the mucous membrane. I cut away the tissue and dismissed the patient with the caution to let me see the case in a few days. On attempting to make an engagement with him for other work he said in substance that he had a goiter, and a case of deafness, which would necessitate his remaining in Dubuque for several weeks for operation and treatment. When he again presented for examination, in about six months, I had forgotten the incident of the unerupted third molar. After finishing the examination of his teeth and ordering my assistant to make engagements for needed dental restorations, he said, "what about that tooth you operated upon last spring?" I looked and beheld a beautiful third molar perfectly erupted, and congratulated him upon the fact that he could have the missing teeth on that side supplied with a bridge. He said that he

had an interesting story to tell me; that after I had operated upon that tooth, the goiter disappeared and the deafness was cured. This is a clinical picture showing that a dental focus removed—but without the extraction of the tooth—cured a goiter and a deafness. This evidence could be continued *ad infinitum*.

The second case was that of Mr. O., a gentleman nearly eighty years of age. About twelve years ago, I had made a number of bridges for him upon roots that were in very bad condition; an operation could not be undertaken. Since that restoration, in spite of my caution that his teeth and gums should have constant supervision and prophylaxis, he had not appeared for treatment or consultation. He presented at the time of this case, with a history of trifacial neuralgia and a pain in the region of the mastoid process. The specialist whom he consulted found no evidence of any ear lesion and sent him to me for a dental examination. I found his mouth in very bad condition. There was profound evidence of pyorrhea, and many of the abutments of the bridges had decayed above the crowns, making filthy pockets for food debris, and a generally bad hygienic condition. In addition to all this, I found, upon a radiographic survey, that there were ten apical areas of radiolucency. I told the old gentleman that his trouble was doubtless due to the condition of his teeth and advised their extraction. He demurred, saying that they had served him well for so many years that he did not think his trouble was due to them and refused an operation. The result was that he made a perfect recovery. That was three years ago, and he still goes about with that reeking mass of filth in his mouth. This incident shows that in spite of dental foci and the retention of the teeth, the patient became well. This case also could be multiplied many times.

The third case was a man of international reputation who was told by three of the greatest specialists in this country that he had a cancer of the throat. He was refused operation and went on a trip around the world. When he returned, he presented to one of the specialists who, when he made an examination, threw up his hands and said, "Thank God it is gone." If that man had had some teeth extracted and had been cured, it would have been credited to the removal of the teeth. If he had gone to a Christian Scientist, it would have been credited to him, or if any other medically credited or discredited agency had treated the case it would have received the credit of the cure. The fact is that, owing to nature's great reparative power, about 80 per cent of all diseases are self-curable, and the power of suggestion is so potent that the particular agency that excites the imagination of the patient at the time when nature affects the cure will, in the nature of the case, receive the credit. I have said before, and I repeat, that there are as many cases of disease that are cured by homeopathy, allopathy, osteopathy, chiropractic, Christian Science, and patent medicines of all sorts as are by the extraction of teeth.

It is not intended to discredit any branch of the healing art, but merely to emphasize the fact that clinical data is misleading at best, and is practically worthless as scientific evidence unless corroborated by facts that are of scientific value in other directions.

I admit that the theory of focal infection is well substantiated by bacteriological and biological findings. That which I am trying to impress upon the dental profession at this time is the fact that the whole matter is extremely overdone and that it is time to take stock of our present position, orient ourselves, and act accordingly.

Before passing to a consideration of our future practice in view of present knowledge, let us for a moment consider the condition of the patient upon whom the practice of the extremists is instituted.

Their present condition is one of about 30 per cent masticatory efficiency if they have the best prosthetic results. I acknowledge the splendid progress made by the prosthetic branch of our profession, but it admittedly is only doing its best to make good nature's deficiency. It is making substitutes and substitutes at best are far from the real thing. The patient, then, is suffering from a lessened degree of masticatory efficiency. I will let the physiologist and biological chemist tell what that means, but if mastication is a necessary part of the digestive process, that patient is from 70 to 90 per cent below par, according to the success of the prosthetist in making a substitute. If he has been relieved of a local focus that was undermining his health, we will not demur, for it is the best that could have been done; but in the wearing of a plate has he been ultimately relieved of such focus? Does anybody know of anything filthier than an old rubber plate? Ask any man that has taken any such plate and has removed the teeth therefrom by the aid of a hot sand bath. No matter how clean the plate has been kept, the odors that arise when subjected to the influence of heat will drive a well-disposed pole cat to the woods in despair. More than the retention of filth in the body of the plate by absorption is the retention of uncounted masses of organisms, pathologic and non-pathologic, in immediate contact with a mucous membrane, the resistance of which has been lowered by the constant contact of a plate. Furthermore, the impact of from twenty or more pounds to the square inch at every closure of the jaws in mastication will, I am sure, provide an entrance of organisms into the system that will have to be reckoned with before we can call ourselves 100 per cent clean as regards dental foci. Recently, an elderly woman called a physician to treat her for arthritis deformans. He immediately informed her that it was undoubtedly caused by her teeth. On learning that she had not had a tooth in her mouth for forty years, he stammered around a bit and then said that it must be from some other source. But I am not so sure that he was not right, for I know of more cases of rheumatism in people that are wearing plates than in those who still have their own teeth. Undoubtedly, this is because the people wearing the plates are older, and therefore more susceptible than the younger, but the point is that in removing teeth and substituting plates the patient is being thrust from the frying pan into the fire.

In view, then, of the knowledge that there are areas of infection in and around the teeth which under certain conditions will cause systemic disease, what should be the attitude of the profession in regard to the whole matter? Should all infected teeth be extracted? Should all teeth with cavities and pyorrhea be treated with the forceps? If we are not to extract all of these offenders, which will we condemn and which will we conserve?

This question leads to such extensive scientific discussion that I will not attempt it. I will simply refer to the research work of men that are competent to discuss the subject, and trust them with the elucidation of its scientific aspects. Dr. Clarence Grieves, in a masterly paper, read before the First District Dental Society of the State of New York,[1] gave us a classification of pathological teeth that is a classic and that aids considerably in clarifying the situation in that it gives us a definite foundation upon which to build. His classification is as follows: Class 1, average teeth, pulps vital; Class 2, sound teeth, pulps affected by pyorrhea; Class 3, abraded teeth, or eroded teeth, occasional pulpal symptoms; Class 4, average teeth, pulps diseased; Class 5, carious teeth, pulps infected; Class 6, infected teeth, septic pulps. In this classi-

[1] *Jour. Nat. Dental Assoc.*, April, 1921, p. 255.

fication, Dr. Grieves holds that only the teeth in Class 2 (the teeth that have been infected thru the medium of pyorrhea, the pulps of which have succumbed to the infection, and teeth imbedded in a mass of pus) and in Class 6 are not amenable to treatment and must therefore be removed. He is most hopeful of the conservation of teeth in Classes 4 and 5. The teeth in Class 4 are those with cavities where it is necessary to remove the pulp, but in which there has been no serious infection. These are the cases in which the dentist has had the best results in the past, notwithstanding the fact that most of them have had the root-canals filled without the modern aseptic precautions.

In Class 5 we have the cases in which we find a putrescent pulp, but there has been no apical infection. The dentin is infected and must, of course, be disinfected, but the prognosis is good, if the work is carefully accomplished.

Class 6, the teeth with apical infections, Dr. Grieves considers hopeless. This is the class that we find with the rarefied area. If there were a definite method of absolutely saying which of these teeth were infected wthout question, we might concur in his conclusions in this class as in the others, but we know upon the authority of such an eminent pathologist as Sir Kenneth Goadby that many of these areas are not infected, and Dr. Grieves himself admits that in the majority of cases examined by him these areas were found sterile. This fact and the additional fact that many of these teeth have been treated and made useful after the areas were removed lead us to the conclusion that there are certain teeth upon which it is wise to attempt conservative treatment. Many of our most eminent authorities have given us the benefit of their research regarding this class, and by following their treatment good results have been attained.

G. V. Black in his *Pathology* gives an account and radiograph of any area that was healed by the method advised in his treatment. Buckley, in the fourth edition of his *Materia Medica, Pharmacology, and Therapeutics,* portrays a number of cases in which the area has been definitely eradicated by the treatment advised by him. Prinz, in the last edition of the *American Textbook of Operative Dentistry,* gives the results obtained by the method advised in his work, and recently this society had the privilege of hearing and seeing the results obtained, in the office of Dr. Hinman under the skilful operation of Dr. Johnson, his associate. It is not the purpose of this paper to enter into a discussion of methods and means of treatment and conservation; it is our intention to attempt only a definite expression on the part of the profession regarding the teeth which should be extracted and those which should be conserved. Therefore we will not recommend any means for the preservation of the infected teeth. We will only say that in our opinion many teeth, even those with areas of apical translucency, are amenable to treatment and should not be extracted simply because the radiograph discloses such an area. If we were to follow the procedure of the men who would eradicate all of the infection from the dental organs, we would find it necessary to extract most of the teeth that were decayed to any great extent, even tho there were no pulpal manifestations, and all of the teeth that were noticeably effected with pyorrhea, for the researches of Collins, followed up by Hartzell and Henrici, have demonstrated the fact that a large percentage of such teeth were pulpally infected. This explains the fact that filled teeth in which the pulp has not been closely approached by the decay, often have had the pulps die at a later date, with a resulting alveolar abscess, if not promptly opened and the canals disinfected.

This introduces the question of pulp conservation. When is it advisable and to what lengths should we go in our efforts to preserve the vitality of that

organ? It is needless to say that we all believe in the preservation of the pulp when it is at all possible to do so, and the destruction of that organ for the building of a bridge should be tolerated in a very few cases. Personally, I have not destroyed a pulp in order to make a bridge for so long a time that I do not remember when it was. With the modern methods of making bridge abutments, it is rarely or never necessary to destroy the pulp unless it is in a state of disease, or unless there is so near an approach to the pulp by the carious process that it would succumb at a later date.

We know by the work of Miller, Black, and others that the dentin is infected to a greater or lesser degree and we know that the pulp is also infected, but our clinical experience demonstrates that a comparatively small number of pulps succumb to the infection if the approach of the filling is not too close. The knowledge we now possess, however, makes it obligatory on our part to attempt some method of dentinal sterilization if possible before placing a large restoration. It has been my habit for a great many years to allow some of the infected dentin to remain in place in large cavities in young children's teeth, where the removal of such would make an almost certain exposure. Knowing the damage that is done to the tooth if the pulp is destroyed before the root apices have closed, an attempt was made to preserve that organ for a few years, at least until the apices of the roots had been properly formed. The method followed was to flood the cavity with a 10 per cent solution of silver nitrate and follow it with a drop of eugenol, after which a drop of zinc oxide in eugenol was allowed to flow over the floor of the cavity. A cement filling was then placed over it and the patient dismissed until a later date. The case was closely watched for pathological symptoms, and if they occurred the pulp chamber was opened, the pulp extirpated and the canals filled. But the experience gained by that treatment and the good results obtained in so many cases lead to the attempt to save some pulps in older patients; however, in adults if there is any appreciable probability of the death of the pulp it is wise to extirpate and fill the canals. It is a very difficult task to sterilize dentin that is badly infected, indeed, it is a very doubtful operation at best, but we know that we can fill canals that are not badly infected, or not infected at all, by the methods of such masters of the art as your own splendid Coolidge to whom we owe very much for his excellent teaching; also our John Buckley; Crane, of Washington, D. C.; Best, of Minneapolis; Johnson, of Atlanta, Georgia; and Percy Howe, of Boston.

It is our practice to attempt the conservation of all pulps that have not become exposed and that have not given a history of definite pathology. If there is a history of hyperemia, we attempt to control it with a dressing or two of the oil of cloves or eugenol, and if the prognosis is favorable, a temporary filling is made of gutta-percha protected by a layer of oxyphosphate, and the tooth allowed to rest for a period of several months if possible. If at the end of that time the patient gives a history of comfort the tooth is filled with every expectation of success. If there are areas of infected dentin, a sterilization of these areas is made by the application of Howe's silver nitrate solution, the silver therein being reduced by the application of eugenol. In all of these cases we do not think it expedient to fill at once. It is wise to wait for a definite length of time to see if there is any resulting pathology; if so, extirpate the pulp immediately. In some cases it may be necessary to attempt a pulp conservation, but with a very great degree of caution. This fact should be impressed upon the patient. In the vast majority of cases, it is far better to remove the pulp and make a root-canal operation before infection takes place than to allow the pulp to die and infect the dentin and

possibly the periapical tissues and the entire system. With the modern asepsis in root-canal work which cannot be emphasized too strongly, we believe that a much larger percentage of pulp canal operations will be successful in the future than has been the case in the past.

Let us sum up the operations which we think are justifiable and good practice.

1. The filling of all cavities in their incipiency, including the finding of such cavities by the dentist. This carries us into the region of prophylaxis, which is outside the domain of this paper, but which is the one greatest thing in dentistry and should be the one first business of every dentist.

2. The filling and preservation of the pulps of teeth with large cavities in which the pulp may be slightly involved but still amenable to treatment.

3. The extirpation of the pulp and the filling of the canals in all cases in which there is a a probability of the subsequent death of the pulp.

4. The extirpation of the pulp and the filling of the canals of the teeth in which there are infected pulps but no apical involvement.

5. The disinfection of the canals and the filling thereof in infected cases in which there is no apical involvement.

6. The treatment and filling of the canals of teeth with apical areas that show a favorable prognosis, always presupposing that there is no systemic involvement. If there are systemic complications, it is wise to extract and get rid of a possible source of infection even tho the tooth may not be the definite cause. We cannot afford to jeopardize the health of the patient for the sake of a tooth.

In conclusion, let me say that the very best thing we can possibly do to prevent systemic infections thru dental foci is to prevent dental disease, and this may be accomplished by instituting a rigorous course of prophylaxis. The best means that we now have of combating the incursions of caries and pyorrhea is a systematic and thoro cleaning of the teeth, but it is my opinion that the next great step in preventive medicine and dentistry will come thru a better knowledge of how to live. Many years ago, Herbert Spencer said that life was a correspondence of the organism with its environment and that disease was caused by a disharmony of the organism with its environment. It is a fact that the human family is still in a state of evolutional flux and that we are not in harmony with our present environment of food. Nature never intended the present man, or man as he is now constituted, to live on soft, starchy, cooked foods, and the fact that we are so living is the greatest contributing cause to the present tremendous avalanche of dental and bodily ills.

After Sir Kenneth Goadby had delivered his splendid lecture in Boston last August, several of us took lunch with him at the hotel and were very much delighted and instructed by his wonderful insight and knowledge of the human organism and its diseases. In speaking of the problem of focal infection, he said that they did not have that problem to contend with in as great a degree in England as we did in the United States. The cause was not so much the seed, for that is everywhere present, but it is the soil. And, said he, pointing to the white bread upon the table, "this is your greatest offender." Too great an abundance of cooked starches and not enough of the coarser and raw foods containing the necessary vitamines. Dr. Percy Howe of Boston is doing some wonderful work along that line which is destined to do more for the conservation of the teeth of future generations than all of the present theories combined.

That deals with the future, however, and, while we should bend our energies to the solving of the problem to the extent of our greatest ability, we must now use the means at hand, and that is, the in-

struction of the children in the principle of clean mouths and a proper manner of eating the food that is given to them. That means a very much enlarged program for our school work, for our free dispensaries, for the propaganda of education, and for the personal determination to do the best work in every individual case.

Discussion

Donald M. Gallie, Chicago: After listening to this splendid paper I am sure everyone present feels there is hope and promise ahead in the practice of dentistry. For the past few years we have had papers presented to this society by radicals, standpatters, and middle-of-the-road men, some claiming that all nonvital teeth should be removed, and others contending that there should be more conservatism. We have now had the subject presented by a man who has his feet on the ground, who is in the middle of the road. I feel that he has given us something that will help all of us, for his conclusions are founded on careful study and long clinical experience.

I desire to congratulate Dr. Conzett on accepting the challenge of the men who are demanding the removal of all nonvital teeth and the ruthless cutting away of surrounding tissues. One of our own members at a recent meeting of one of our district societies threw down the gauntlet to those radicals and reminded his audience that it would be well, before accepting the unproved theories of this group, that they read and study the work and findings of our teachers of oral pathology and surgery. I question if any one present can name the head of the departments of oral surgery and pathology in any of our dental colleges who support the claims of the 100 per cent men.

When Dr. Hunter, the eminent British surgeon, presented his memorable paper before the students of McGill University, it made a profound impression upon the professions of medicine and dentistry. In fact, we were in a measure stampeded, the mouth conditions which he cited were conditions found in the mouths of the people of England and Scotland, and those of you who are familiar with the old practice of leaving old diseased roots in the jaws and placing dentures over them and who are familiar with their limited knowledge of the treatment and filling of root canals, can readily understand why Dr. Hunter was so strong in his indictment of dentistry. Our medical brothers feel there could be no exception to these mouth conditions as presented by Dr. Hunter, and became unreasonable in their demands for the removal of the teeth. A little later Dr. Mayo, before a great audience in this city, said the health of future generations was up to the dentist; would he accept the challenge and responsibility? Since then many dentists have felt that they should remove everything possible that could now or in the future have any bearing upon the health of the people. We have dentists everywhere who are quick to capitalize any new idea and are loud in proclaiming the virtues and benefits of the new practice. Too often our medical brothers are influenced by these men instead of by the careful conscientious practitioner.

I was pleased to hear Dr. Conzett say he had no quarrel with the medical profession. We all know that the conscientious medical man is anxious to do what is best for his patient. He may not always see things as we do, but the great majority are anxious to work with us and be guided by our experience, and today most patients are referred back to us, instead of sending them to the exodontist. I think one of the most serious problems that confront us today is combatting the influence of the radiographers who are simply picture-takers and who presume to diagnose conditions and direct patients into the channels of charlatanism.

I recently had a patient come to me who was greatly alarmed. He had been to one of these picture-takers and had all the teeth radiographed. Three upper teeth had been treated and root-canals filled; two were in excellent condition, one had an imperfect root filling and apical area; two teeth on the opposite side were vital, but had layer restorations in them. This picture-taker told him that his mouth was in a terrible condition and that he should have ten teeth removed. Furthermore, he must not go to an ordinary dentist or a regular extractor, but to an oral surgeon who would remove them surgically. He gave the man the card of a near relative in another building who would do the surgical and financial removing. There is no question that in the past we retained too many diseased teeth in the mouth. It is also true that of late we have removed too many good ones, and it is only by following conservative, but progressive men like Dr. Conzett that we will do what is best for humanity.

In regard to removing the teeth and substituting them by any prosthetic means, whether by bridge, partial or full denture, we know that the masticating efficiency is lessened. I am not as much concerned about the old people with the old rubber plate as Dr. Conzett, because I have some old people of seventy-six or seventy-eight who have been wearing rubber plates since they were twenty-six or twenty-eight. I am very much interested in Dr.

Grieves' classification, for he is a man of splendid scientific attainments and I think many of us agree with him in his conclusions.

We are all familiar with Class 2, tooth sound, but embedded in a cushion of diseased tissue and pus, and Class 6, with infected pulps and area of radiolucency, a great menace in every way. It is in Classes 4 and 5 that we are vitally interested because they embrace such a great number of the cases that come under treatment.

What a silver lining to the dark clouds we have seen of late. At a recent meeting of the Association of Dental Teachers, held in Indianapolis, I was much interested in a paper presented by Dr. Clyde Davis, of the University of Nebraska. He showed us numberless slides of Class 4 and described his treatment of this kind of case. He takes a fine broach and bends it at right angles; close to the point he sharpens this to a razor edge, introduces it down about one-third into the canal, turns it around, severing clean the pulp tissue (it sounds to simple!). This operation he calls pulpotomy. He claims he has performed this operation hundreds of times and has complete records of all his cases without a failure. He showed numberless slides to bear out his contention. In that audience were Drs. Coolidge, Frederick Noyes, and many others well known for their work in root-canal technic. Dr. Davis challenged anyone to disprove his claims. No one present could, as none had been treating diseased or affected pulps in that way. However, Dr. Davis may be right, but this proves that what can be considered good practice today is out of date tomorrow.

A number of years ago a distinguished member of our profession from New York talked for two hours before this society about treating, enlarging, and filling root-canals, so that the root apex would be encapsulated by the filling material. We were told by all the experts that we should fill all the canals to the root end, even tho we had to cut thru tooth structure. Today we are told to beware of going thru the end of some roots, to go only to the cementum, and we are told that this cementum sometimes will extend two millimeters beyond the canal ends. How well I remember how I was taken to task some time ago before this society when I made the statement that if the radiograph showed a root-canal filled to within two millimeters of the apex and no evidence of apical disturbance that I would not disturb that so-called imperfect root-canal filling. Two men who followed me in the discussion disagreed with me and declared that such practice was criminal, and now they say this infecteed apex is cementum and should be undisturbed.

I am sure we all agree with Dr. Conzett in his plea for conservation of the pulp whether it be in preparing teeth for bridge abutments or for fillings.

In summing up this whole question, the answer is, do the very best you can. Be honest and conscientious; use good common sense and remember that nature has not entirely forsaken us.

Robert J. Cruise, Chicago: In the early part of the paper Dr. Conzett made reference to the progress of the profession. As regards progress in dentistry along purely mechanical lines is concerned we all know it has been perfectly astounding during the past few years and I think we as a profession are entitled to take 100 per cent of the credit, but as regards the progress of dentistry along the lines which have forced the recognition from the world that we have in dentistry one of the greatest aids toward good health and prevention of disease, I think there is no use in pretending too much; but we should attribute pretty nearly 100 per cent of the progress of dentistry along those lines to the medical profession. I may meet with some opposition in that statement, but that is my stand. I am not a medical man, but a dentist, and I want to support my statement along that line by quoting a brief extract from a paper which appeared more than forty years ago. It represents the experience of a medical man not in this country, a physician in Ireland, and it contains very evidently a warning which was not taken up by our profession. The paper appeared in the *Lancet* in 1879 under the title of "Autointoxication thru the Mouth, a Possible Cause of Relapse in Enteric Fever."

"I am satisfied from experience that an unhealthy state of the mouth is a fertile and very common cause of disease. We are all agreed upon the importance of fresh air in contending with tuberculous and other cachexias from the poisonous effect of sewer gas, rebreathed air, and the like. What then, are we to expect when every breath that the patient draws is infected by an unclean mouth? Besides bad teeth we find many other morbid conditions of the mouth, ill-adjusted and nonremovable false teeth, cemented to diseased roots, suppurating alveolar abscesses, often painless, unhealthy conditions of the nasal and pharyngeal mucous membranes, a gross neglect of cleanliness and so on, which means, in fine, that the patient is breathing an infective atmosphere and swallowing poisonous secretions. I am satisfied that this source of ill health is not attended to sufficiently in everyday life and is too much neglected by the medical and dental professions."

That appeared more than forty years ago, at a time when the dental profession was full of men of thought and brains and ability, and it must have reached them. Yet they seem to

have remained more or less deaf to the warning. This was followed by warnings from men like Dr. G. W. Ord, of London. Finally, Dr. Hunter, at Montreal, according to Dr. Gallie, stampeded the profession. He stampeded his own profession. If he stampeded ours he did the best thing that he could have done for it. Therefore, altho we are not absolutely in harmony with the medical men in everything, I stand for 100 per cent of thanks to the medical profession for the fact that we are today on a par with any other branch of the healing art.

The best thing that has happened to us is of course the best thing that could have happened for our patients. The dental profession is supposed to be a very fruitful ground for fads. There is something in that. When I entered the dental profession the fad of the hour was cataphoresis, and I bought an elaborate outfit. This was followed by the porcelain inlay fad. Everything was porcelain. That died a natural death but left a certain residue of benefit behind it. But, as we know, it was a fad. The focal infection fad, so called, however, is not a fad; it is a *serious reality*, it is a truth and a problem. I do not care what you say about fighting this so-called stampede and not allowing the medical men to convince you that this tooth or that tooth or every tooth should be extracted—that problem must be solved, and it will be solved by the brains of this profession. Men are working on it now and will continue to work until they arrive at something definite. It is not well to say that there is a little area of translucency at the root but we will fill it up and take a chance. What are we to do? We do not know how to determine what is an infected area. I have made some experiments in a humble way, and many other men are making experiments. I have taken two teeth where there had been a translucent area, and the best radiologist told me these two areas were exactly alike. I treated these teeth according to the most approved manner. I followed Dr. Buckley's teaching as closely as I could. I filled the roots and while the radiograph did not show a mushroom over the apex it showed properly filled roots. I let them rest for some months and then had them radiographed again. Both cases showed some bone regeneration, in one not as much as the other. I had a victim who was willing to subject himself for the good of humanity and I extracted these teeth. I excised the ends of the roots and prepared them for bacteriological cultures. In one case I found a most beautiful bacterial growth, while the other was negative. You may say that along the line some mistake was made, that I infected one of the teeth, that my treatment was not correct, but the radiographic reading was the same in both of them, and therefore I did not know from that source. We have to find some means of ascertaining without extracting every tooth whether there is a diseased area there or not. Some man will give us a method by which we will know whether the diseased area is removed, whether the tooth has a diseased area or not.

The keynote of the solution of the problem which faces us in dentistry today is the keynote which must be found to solve the puzzling problems of the hour—honesty. One of the biggest financial and political economists of the country, Mr. Babson, of New York, spoke here recently, and he made the statement that in spite of the Federal Reserve system and all the other modern aids to commercial life, this country would be thrown into one of the greatest panics it had ever seen, unless business men are more honest and live up to their contracts. After all, that refers to the professions also. If we will be honest and endeavor to acquire the very latest knowledge thru all the channels which gives us the opportunity—and it is not necessary to take a post-graduate course every two months in order to do that—I think we can truthfully say that we shall have reason to be proud of the profession of dentistry.

Robert E. Blackwell, Chicago: Dr. Conzett's paper certainly represents the trend of the best thought in dentistry today. There is, perhaps, a reaction against the overworked focal infection idea. I say "perhaps" purposely, because we do not know today whether that idea is overworked or not. Certainly every diseased tooth that can be put into a healthy and comfortable condition, and that does not interfere with some prosthetic restoration, should be retained.

There is some question about the efficiency of the natural denture, for that matter, before the extraction of diseased teeth, and it may be that an artificial denture of 30 per cent efficiency might be more serviceable than the natural denture before the extraction of the teeth. But there is something in Dr. Conzett's paper which might intimidate some of us in carrying out our belief in the removal of focal infection—that is that we would not be able to restore normal efficiency with an artificial denture.

We need not worry much about the denture being a focus of infection. The mucous membrane is a protective covering, the same as the skin is a protective covering, and even tho the infection may be present it may not be forced thru that natural protective covering unless that tissue is abraded or inflamed.

There is no doubt that a great many, but perhaps not as large a number as some of us believe, are extracting too many teeth. They are extracting teeth by the wholesale. It has been my privilege to observe a great

many patients coming into the school clinics, bringing radiograms with them, and from that observation and from consultation with radiographers who are real professional men with a knowledge of pathology, I am of the opinion that at the present time probably the majority of the men in the dental profession today are not extracting enough teeth.

Charles E. Bentley, Chicago: This is the most eventful epoch in the history of dentistry, and I do not believe that there is any group of men in any calling who approach their daily tasks with such fear and trepidation as does the honest, conscientious dentist, for he knows the importance and the responsibility of trying to treat any of the diseases mentioned. In 1911, Dr. Hunter startled the dental profession out of its snug complacency; he said that our methods of practice were responsible for many systemic diseases, but what did the charge amount to? He only observed the clinical findings upon the removal of these teeth, but that is not science. It was not until 1918 when Dr. E. C. Rosenow, thru his experiments, brought to our attention the scientific point that morally and scientifically indicted us unless we accept the challenge and get from under. Dr. Hunter only cited what he saw on clinical experiments, but Rosenow made hundreds of experiments and proved them over and over again. He took, for instance, the micro-organisms from appendiceal cases and injected them into rabbits, and found that the majority of these rabbits had appendicitis. He made more than two hundred experiments before he published any results. One of the most important things that Dr. Rosenow found was the mutability of micro-organisms. That is to say, that the focus may be at one point and the zone of infection may be at a remote point, and that the character of the same organism is different in its reaction in the same body at the same time. That mutability of micro-organisms is what we have to contend with, and we cannot master it. What has been the effect? Dr. Gallie says Dr. Mayo issued the challenge and that we accepted it. How have we accepted it? There has been a lack of standardization in almost everything. One man says to put a mushroom on, Dr. Howe says to put nitrate of silver in, Dr. Johnson says neither, the Callahan method is advanced by many, and we have a multiplicity of methods but no standardization.

Dr. Conzett referred to the classification of Dr. Clarence Grieves, but Dr. Grieves also says that nothing sufficiently strong to do injury to the apical tissue should be put in that root in treatment. We have been using one thing and another in that root for sterilization, what are we going to do and how are we going to find out what we should do? Further, we have been devitalizing teeth with arsenic and who can tell whether that arsenic carried to the apices of roots of a tooth will not do harm? How are we going to get a scientific basis on which to base a conclusion to meet the challenge of Dr. Mayo and Dr. Rosenow unless we do some of it ourselves, and how can we do it? I shall tell you how we can all contribute. Dr. A. D. Black at the last Illinois State Dental meeting presented a scheme whereby every dentist can keep *case records* of every devitalized tooth and every pyorrhea tooth that he may treat. At the end of two, three, or five years by such records we will have a mass of testimony upon which we can base at least some scientific findings. Every one of us can adopt that system. We may have only twenty-five cases in a year, and yet we can turn them over to some person like Dr. Black, and in five years from now we can have in this society a tremendous amount of facts that will go a long way toward the standardization of our practice in this regard.

Again, I want to make one more plea to the young man. The young man is the hope of the dental profession because he has before him vision, youth, everything that counts and everything to gain, and I wish they would in groups of four, or five, or seven, form *study* clubs in their neighborhood and get a master to teach them. Go into this work even in a desultory and primitive way, in research along some of the little things and some of the big things. We have made tremendous advancements, but the greatest advancement yet to come is the advancement of our future achievements.

Dr. Conzett said that the ideal condition is not the reparative but the preventive one. If there was ever a hope for our profession it lies there. The convention of the Chicago Dental Society, which was magnificent in its total and management, had the dominant note of prevention, if possible, of caries, and prevention of disease, so that the coming generation may be physically fit. This great big tidal wave for care for the children's teeth that is now sweeping over the country commenced right here in the city of Chicago. It was the Odontographic Society which, in 1909, authorized a committee to make a survey of every city in the civilized world of 25,000 or more, to see what they had done for the children's teeth. That committee took a year to do the work and it reported in 1910. The results of that work were published in the *Dental Review* of that year. Immediately the members tried to practicalize some of the things they had heard of in other countries. They went to the Board of Education in Chi-

cago and were received with scant courtesy. Then they started a little experimental station at Elgin, but as the dental service was voluntary it soon died. But in Aurora they did establish a station and it remained there for one year and six months, and every dentist was interested in it. The mass of data that that committee gathered was then taken up by Dr. Ebersole, of Cleveland, who has since died, and the practice that was endemic became epidemic. I say this because I think Chicago is entitled to the credit for commencing this great system that is having such an effect upon the world in general; we should render unto Caesar the things that are Caesar's.

Dr. Conzett (closing): I think I said very plainly in my paper that no diseased tooth should remain in the mouth, and I believe that absolutely. If the tooth cannot be restored to a state of health it should be extracted. But I do not believe that all diseased teeth will remain diseased. It is possible to restore diseased teeth to health, and in many instances those teeth have rendered valued service for years to come. If a tooth can be rendered healthy it is for us to render it healthy, because we all admit that artificial dentures are not as good as the natural teeth, and it is our business as dentists to conserve the natural teeth as much as possible. We should conserve as many of the teeth as possible that have no radiolucent areas. If coupled with the radiographic evidence is the clinical evidence that that tooth can be put into a state of health, we should treat the tooth because, as his been truly said, the radiograph is not the ultimate evidence. There are some teeth that show no evidences of radiolucent areas even when we know they are present. There are at other times evidences of the radiolucent areas when they are not actually present. Dr. Goadby stated that in many cases where there were apparent radiolucent areas around the tooth he had cut down and found the root perfectly healthy without any absorption of the bone. He did not know what caused it but thought probably there was some chemical cause and not disease. Dr. Grieves is authority for the statement that many of our pathologists are discrediting the whole proposition. One of the very best pathologists we have in this country told me that he had made an investigation under the most approved methods which had been worked out by himself and a radiologist and pathologist with the result that in 80 per cent they were sterile. If those things are true, is it not sad commentary upon the dental profession that we are sacrificing 80 per cent for the 20 per cent that are diseased? If we cannot restore a tooth to perfect health it should be removed. The great problem is to differentiate the diseased tooth from the healthy tooth, and we do not yet know how to do it.

Some one spoke about the apex and filling the root clear to the apex. In a great majority of cases this is not the best practice, beacuse I am convinced that many of the teeth that are not filled to the apex are still in a state of health.

In Dr. Cruise's discussion he brought out many things that might have been overlooked. Many of our epidemics come to us by suggestion. I will cite just one case, a patient was referred to me by a physician because of bad rheumatism of the elbow. She had suffered for months and was not able to sleep. I made a radiographic survey of the teeth and found some roots were as badly filled as most of us fill them, but there were no translucent areas. I said to her: "I cannot find anything about the teeth." But on more extended search around the lower third molar I did find a little translucent area. I put in a probe and brought forth a little pus. I then said to the patient: "I think perhaps this may be it," and she said: "Yes, the pain has gone!" It immediately ceased and she has not suffered since then. We might prolong this discussion indefinitely, but these things are not scientific evidence.

The thing we must do is to try to do everything possible to study this problem from every possible angle. It is not a theory but a condition that confronts us and if we would give our patients any degree of masticating efficiency, we must conserve just as many of these teeth as we possibly can.

AN INTRODUCTION TO THE MUSCLES OF MASTICATION[1]

By A. LeROY JOHNSON, D.D.S., Boston, Massachusetts

(Read before the National Dental Association, Boston, Massachusetts, August 23-27, 1920)

WE HAVE made dissections of the muscles of mastication of human subjects, having a variety of occlusal conditions. We have no particular contribution to make, no definite conclusion to offer. The studies which we show constitute the preliminary steps of a more extensive investigation which the department is carrying on, and are exhibited because of their bearing upon many disputed questions in orthodontia, notably to the question of the relation of abnormal antero-posterior conditions of occlusion to the temporo-mandibular articulation, and also to the idea of muscle training as exemplified in recent orthodontic literature.

The functional activity of muscles can best be studied upon the living subject, yet it is quite true that dissection is the logical foundation upon which to build a knowledge of muscular activity. An accurate knowledge of the origin and insertion of a muscle is essential in determining its action. This applies more particularly to the insertion which is a direct indication of activity. The fibers of the temporal muscle have their origin over a broad surface presenting a fanlike appearance, while the insertion in the coronoid process of the mandible is comparatively narrow. It is the direction of the tendon of insertion that indicates the character of activity rather than the distribution of muscle fibers upon the bones of the cranium. The opportunity for observing the exact attachment of the insertions of the muscles and determining the relations of the different groups to each other gives to dissections their particular value.

While it is not our intention at this time to enter into a discussion of the nature of the function of muscle tissue, we would emphasize the necessity of a review of the evidence of embryology and comparative anatomy in the study of the activity of any group muscles. In these two branches of science is the picture of man's evolution as well as the basis from which to determine the relative values and tendencies in development. Embryology emphasizes the fact that muscles evolve in groups. Keith says: "The muscles of mastication arise in the mandibular arch. A single muscular mass is apparent at the end of the first month; during the second month it is differentiated into several parts—the internal pterygoid being the first to separate from the common mass. The masseter and external pterygoids are derived from the primitive temporal muscle. The external pterygoid is a late addition; even in man it is often imperfectly separated from the temporal." Comparative anatomy furnishes evidence of the modification of structures and adaptive changes in evolution. The anterior belly of the digastric once a part of the mylohyoid is now a separate bundle of muscle fibers. Knowledge of this character is fundamental to one who assumes to train muscles intelligently

[1]Prepared by the Orthodontic Department of Tuft's College Dental School.

for, as MacKenzie says, "the particular functions of any muscle are the result of the evolutionary history of that muscle." Variations in musculature, as in other structural formations, often find their explanation in embryological evidence, and functional activity can only be understood in the light of a knowledge of the phylogeny of muscle groups derived from the study of comparative anatomy.

For convenience of study it is perhaps necessary to individualize the different organs and parts of the body, and judging from the ideas current in the literature such a tendency has been carried to unreasonable extremes. In teaching the anatomy of the face and jaws each bundle of muscle cells is usually treated as an entity. We learn of the origin and insertion of the masseter muscle, its nerve control, its blood-supply and its action as if it were entirely distinct from all other structures. We think of muscles, tendons, ligaments, and bones as distinct structures. Yet the first impression one gets in making dissections is of the continuity of structure, and the interdependent relation of all parts in function which this continuity of structure entails. The arbitrary way in which the material of anatomy is ordinarily presented is well illustrated in reference to ligaments. Take for example the stylo-mandibular. It extends from the styloid process of the temporal bone to the angle of the mandible, and has been referred to as "one of three ligaments limiting the movements of the mandible." Even tho such a statement is in a sense true if the study of the ligament is left there, the conception produced is so limited that it is misleading, and the real nature of the ligament and its functional significance not appreciated. Perisol says, and we have carefully corroborated his view in our dissections: "Covering the anterior surface of the masseter is a thin layer of fascia attached above to the zygoma and fading out anteriorly beneath the facial muscles. Posteriorly it becomes thicker and divides into two layers to inclose the parotid gland, the superficial layer becoming continuous behind with the layer of deep cervical fascia which incloses the sterno-mastoid muscle, while the deeper layer is connected internally with the styloid process and joins the deep cervical fascia below. A thickening of this deeper layer forms a flat band, the stylo-mandibular ligament, which passes downward and outward from the styloid process to the angle of the jaw."

From what is known of the physiological nature of ligaments, tendons, and osseous structures in relation to muscle tissue, it is clear enough that altho the stylo-mandibular ligament is "one of three which limit the movements of the mandible," the ligament itself marks the physiological balance of muscular activity. The ligament is a passive structure as bone is passive, only in a different degree. Treated in this way it takes on a different value than when referred to as a distinct band of fascia "which limits the movements of the mandible." It puts the responsibility on muscle tissue as it should be. "The quantity of motion in a joint is regulated by the power of contraction and relaxation of the muscles which act on it" (MacKenzie).

Muscles evolve in groups and tho each one performs some special function it does not act alone. Muscle contraction involves muscle relaxation and one is as positive a factor in muscle function and connective tissue modification as the other. An individual muscle cannot be trained without at the same time training others. At present in treating the masticatory apparatus we have no means of diagnosis to determine just which bundle of muscle fibers, if any, is at fault. One has but to study the structures in dissection, to say nothing of the more complex nature of living tissues, to be impressed with the meagerness of our knowledge of the whole subject of the musculature of the human dental apparatus.

THE JOURNAL of the NATIONAL DENTAL ASSOCIATION

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Editor and General Manager,
OTTO U. KING, D.D.S., F.A.C.D., 127 N. Dearborn St., Chicago, Illinois.

Associate Editors,

THOMAS P. HINMAN, D.D.S., F.A.C.D., Atlanta, Ga.
HARVEY J. BURKHART, D.D.S., L.L.D., F.A.C.D., Rochester, N. Y.
THOMAS B. HARTZELL, D.M.D., M.D., F.A.C.D., Minneapolis, Minn.

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VOL. 8 MAY, 1921 No. 5

Editorial Department

DR. GARRETT NEWKIRK

When a great man dies he leaves a vacancy in the world, when a good man dies he leaves a sadness, when a man dies who is both great and good we find it hard to be reconciled to his loss. Such a man passed peacefully away in Pasadena, California, on April 6, 1921. Dr. Garrett Newkirk was known wherever dental literature was read, and in his later days he was known far beyond the bounds of professional literature—out in the broad expanse of general literature. In years gone by he was a prolific contributor to dental periodicals and textbooks, and whenever he wrote anything it was worth reading.

Latterly he had devoted most of his energies toward the preparation of manuscript connected with the life of Lincoln. No man ever

loved Lincoln more passionately than did Dr. Newkirk; no one studied him more thoroly. Of all the myriad publications that have been issued about Lincoln, not one is truer or more exquisite in workmanship than the little volume recently issued by Dr. Newkirk, entitled *Lincoln Life Sketches*. A more pretentious work on Lincoln was under way, and we believe was practically completed at the time of Dr. Newkirk's death. If one would know Lincoln at his best, all one has to do is to read what Dr. Newkirk has written of him.

He was a very liberal contributor to the daily press on the current topics of the day, and during the late war he exhibited the keenest insight into the issues at stake. Some of his articles written at that time show a grasp of the situation and a prophetic vision of the ultimate outcome which stamped him as one of the clearest thinkers among the many who ventured to express themselves on that momentous question.

Dr. Newkirk was very versatile in his literary work, and wrote both in poetry and prose. Among the publications which at various times contained his articles might be mentioned *Round Table*, *Youth's Companion*, *Outlook*, *Bird Lore*, *St. Nicholas*, etc. In the last-named magazine there appeared years ago a series covering many months called "Rhymes of the States," which were subsequently gathered into book form and published as a geography for boys and girls.

He was a lover of children and keenly sympathetic with them in all their interests. He kept up a wide correspondence with the boys and girls among his relatives, as well as children outside his family. He was extremely fond of birds, and wrote extensively on this subject. He knew birds like an open book, and never wearied of discussing their habits and peculiarities. He maintained an acquaintance with many of them individually. He kept his back yard supplied with food and shelter for them, and had the pleasure of welcoming various members of the feathered tribe to his home annually for years.

A man with a heart and mind like his must inevitably weave himself into the warp and woof of the events of his fellow-men. No one took a keener interest in the affairs of the day, and no one expressed himself more forcefully or intelligently than he. He was never neutral except where neutrality represented common sense, and no one had to seek long to find out where he stood.

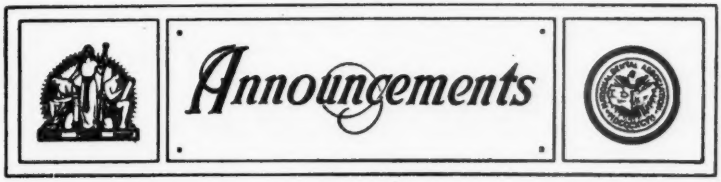
Garrett Newkirk typified the best there is in professional, political, and social life. He was a sheet iron anchor when men's minds ran riot with extremes of fads and fancies—he always took the second, sober thought. As a friend he was lovable, and as a companion, entertaining. The hour never grew dull or long when Dr. Newkirk held the boards. Exceedingly well informed himself, he had the happy faculty of impart-

ing information to others, and he never grudged time nor strength when it came to giving the best there was in him.

Above all he was a lover of the home and fireside, and she who sits today beside the vacant chair which she saw filled for nearly half a century must console herself with the blessed memory of what he was and what he did. All that he meant to the rest of the world was as nothing compared with what he meant to her, and as the shadows fall in the evening on the slopes of his beloved hills she may rest secure and serene in the cherished glow reflected from the beneficence of a life well lived.

"SLAUGHTER" OF THE TONSILS—AND TEETH!

In a recent number of the *Journal of the Indiana State Medical Association* there was a comment on the "slaughter" of tonsils and thyroids, with a suggestion that a little more study of these individual cases might result in a more rational therapy. A correspondent reminds us that we also ought to condemn the "slaughter" of the teeth, for it is perfectly shocking how frequently we find very young people wearing full sets of artificial teeth, both above and below, the natural teeth having been sacrificed on the altar of misguided judgment, perhaps on the part of some dentist who has gone to extremes concerning absorption of infection from dental pathology. The frequency with which dentists recommend extraction of all of the teeth in young people seems criminal, and it may be seriously doubted if in a single one of such instances there is any justification for such radical procedures. Nowadays every dentist owns an X-ray outfit, and he glibly talks about infected foci about teeth as depicted by the X-ray plate, when as a matter of fact it may be doubted if he knows how to interpret an X-ray plate, to say nothing of judging whether or not the interpretation points to the necessity for such radical measures as the withdrawal of the offending teeth. We do not doubt the urgent necessity of removing foci of infection in the mouth, whether it be tonsils or teeth, but we do question the propriety of sacrificing as many teeth as we frequently find to be the case in comparatively young people who all their lives have been reasonably thoro in their attention to sanitation of the mouth and who have given little evidence of disease in and about the teeth tho perhaps suffering from some constitutional disturbance that indicated foci of infection somewhere. It really seems that there is room for very great improvement in the therapy of the average dentist, and it is hoped that very soon the question of extraction of the teeth will be on a more rational basis.—*Journal of the Indiana State Medical Association*, February 15, 1921.



CALENDAR OF MEETINGS

NATIONAL SOCIETIES

National Dental Association, at Milwaukee, Wisconsin, August 15-19.

National Society of Denture Prosthetists, at Milwaukee, Wisconsin, August 1-13, Hotel Medford.

National Association of Dental Examiners, at Milwaukee, Wisconsin, August 15, Hotel Pfister. T. A. Broadbent, Secretary-Treasurer, 25 E. Washington Street, Chicago, Ill.

Psi Omega Fraternity, Biennial Grand Chapter, August 10, and National Alumni Chapter, August 15, at Milwaukee, Wisconsin Hotel. M. M. Printz, Supreme Councillor, 25 East Washington Street, Chicago, Ill.

Xi Psi Phi Fraternity, Alumni Association, August 15, at Milwaukee, Wisconsin Hotel. J. Emmett Northcutt, Secretary, St. John and Elmwood Avenue, Kansas City, Mo.

Delta Sigma Delta Fraternity, August 15, at Milwaukee, Hotel Pfister. R. Hamill D. Swing, Supreme Scribe, 1623 Walnut Street, Philadelphia, Pa.

Association of Military Dental Surgeons, at Milwaukee, August 16 and 17. G. H. Cassady, Secretary-Treasurer, Presidio, San Francisco, Cal.

Dental Veterans of the World War, at Milwaukee during meeting of the National Dental Association. Harry L. Hosmer, Secretary, Detroit, Mich.

American Academy of Periodontology, May 9 and 10, at Hotel Commodore, New York City. J. Herbert Hood, Secretary, 1011 Guardian Building, Cleveland, Ohio.

American Dental Library and Museum Association, August 15 and 17, at Milwaukee. B. W. Weinberger, Secretary, 40 E. Forty-first Street, New York City.

American Institute of Dental Teachers, third week of January, 1922, at Montreal, Quebec. Abram Hoffman, Secretary, 381 Linwood Avenue, Buffalo, N. Y.

STATE SOCIETIES

May

Arkansas, at Little Rock, (16-20).
Illinois, at Peoria (10, 11, 12).
Indiana, at Indianapolis (16, 17, 18, 19).
Iowa, at Des Moines (2, 3, 4, 5).
Maryland, at Baltimore (25, 26, 27).
Massachusetts, at Boston (4, 5, 6).
Montana, at Billings (16-21).
Nebraska, at Omaha (16, 17, 18, 19).
New York, at New York City (11, 12, 13, 14).
North Dakota, at Minot (19, 20).
Pennsylvania, at Philadelphia (3, 4, 5).
Tennessee, at Nashville (17, 18, 19, 20).

June

California, at San Francisco (June 27 to July 2).
California (Southern) at Los Angeles (20, 21, 22).
Florida, at Gainsville (14-17).
Georgia, at Macon (8, 9, 10).
Idaho, at Boise (June 27 to July 2).
Maine, at Bar Harbor (21, 22, 23).
New Jersey, at Atlantic City, Steel Pier (1, 2, 3).
New Mexico, at Albuquerque (20-25).
North Carolina, at Charlotte (28-30).
South Carolina, at Greenville (14, 15, 16).
Utah, at Salt Lake City (20, 25).

July

Washington, at Vancouver, B. C.

August

Wisconsin; no state meeting because of the National Dental Association meeting in Milwaukee.

October

Virginia, at Richmond (11, 12, 13, 14).

December

Ohio, at Columbus (6, 7, 8).

MEETINGS OF STATE BOARDS OF DENTAL EXAMINERS

Alabama, at Birmingham, Birmingham Dental College, Avenue F and Twentieth Street, June 20. H. Clay Hassell, Secretary-Treasurer, 616 Twenty-second Avenue, Tuscaloosa.

Arkansas, at Little Rock, Hotel Marion, June 27, 28, 29. H. J. Green, Secretary, Paragould Trust Company Building, Paragould, Ark.

California, at San Francisco, May 21; and at Los Angeles, June 25. C. A. Herrick, Secretary, 133 Geary Street, San Francisco.

Connecticut, at Hartford, June 23, 24, 25. Robert W. Strang, Recorder, 886 Maine Street, Bridgeport.

District of Columbia, at Georgetown University, Dental Department, 920 H Street, N. W., June 20-24. H. Barnhard, Secretary, 1225 New York Avenue, N. W., Washington, D. C.

Florida, at Jacksonville, June 9-13, inclusive. R. P. Taylor, Secretary, 414-15 St. James Building, Jacksonville.

Idaho, July 12. Paul Davis, Director, Bureau of License, Boise.

Indiana, at Indianapolis, June 20-25. H. C. McKittrick, Secretary-Treasurer, 1006 Odd Fellows Building, Indianapolis.

Iowa, at Iowa City, College of Dentistry, June 6. C. B. Miller, Secretary, 726 Fleming Building, Des Moines.

Kansas, at Wichita, June 20. G. F. Ambrose, Secretary, 111½ S. Main Street, Eldorado.

Kentucky, at Louisville, Dental Department, University of Louisville, June 7. J. H. Baldwin, Secretary, Francis Building, Louisville.

Maine, at Augusta, State House, July 7, 8. 9. Henry Gilman, Secretary, 192 State Street, Portland.

Maryland, at Baltimore, Dental Department, University of Maryland, June 7, 8, 9. F. F. Drew, Secretary, 701 N. Howard Street, Baltimore.

Mississippi, at Jackson, Senate Chamber of the State Capitol Building, June 21. Burt J. Marshall, Secretary, Marks, Miss.

Montana, at Helena, July 11. Frank J. Bell, Secretary, P. O. Box 425, Billings.

Nebraska: practical, at Omaha, Creighton Dental College, and at Lincoln, University of Nebraska Dental College, June 7 and 8; written, at Lincoln, State House, June 9, 10, 11. H. H. Antles, Secretary, Department of Public Welfare, Lincoln.

New Jersey, at Trenton, Second Regiment Armory, June 27-July 1. John C. Forsyth, Secretary, 429 E. State Street, Trenton.

North Carolina, at Charlotte, June 25. F. L. Hunt, Secretary, Asheville.

Oklahoma, at Oklahoma City, State Capitol Building, June 6 to 11, inclusive. L. M. Doss, Secretary-Treasurer, 245 American National Bank Building, Oklahoma City.

Pennsylvania, theoretical, at Philadelphia, Musical Fund Hall, 808 Locust Street, and at Pittsburgh, College of Pharmacy Building, Bride and Bluff Streets, June 23, 24, 25; practical, at Philadelphia, Evans Dental Institute, and at Pittsburgh, University of Pittsburgh, June 25. Alexander H. Reynolds, Secretary, 4630 Chester Avenue, Philadelphia.

Rhode Island, at Providence, State House, June 28, 29, 30. Albert L. Midgley, Secretary, 315 Butler Exchange Building, Providence.

South Carolina, at Greenville, Park School, June 13. R. L. Spencer, Secretary, Bennettsville.

South Dakota, at Sioux Falls, June 28, 29, 30. L. R. Walston, Secretary, Redfield.

Tennessee, at Nashville, Vanderbilt Dental Department, June 14. F. W. Meacham, Secretary, Hamilton National Bank Building, Chattanooga.

Texas, at Dallas, June 20-24. Harrison B. Cave, Secretary, Wilson Building, Dallas.

Vermont, at Montpelier, State House, June 27, 28, 29. Harry F. Hamilton, Secretary, Newport.

Virginia, at Richmond, June 14. J. P. Stiff, Secretary, Fredericksburg.

West Virginia, Charleston, June 28, 29, 30. R. Mason Hite, Secretary, Mannington.

Wisconsin, at Milwaukee, Marquette Dental College, June 18-25. William Kettler, Secretary, 480 Berlin Arcade, Milwaukee.

Wyoming, at Cheyenne, June 28-July 2. Peter Appel, Jr., Secretary, P. O., Box 643, Cheyenne.

STUDY CLUBS AND OTHER SOCIETIES

Dental Alumni Society, University of Pennsylvania, June 10, in the Thomas W. Evans Museum and Dental Institute, Fortieth and Spruce Streets, Philadelphia, Pennsylvania. Secretary, Z. T. Jackaway, 1506 E. Susquehanna Avenue, Philadelphia, Pa.

Pennsylvania Society of Dental Surgeons, October 12-15, Philadelphia, Pa.

SOUTH CAROLINA STATE DENTAL ASSOCIATION

The South Carolina State Dental Association will convene in Greenville, South Carolina, June 14, 15, 16, 1921.

ERNEST C. DYE, *Secretary*
Greenville, S. C.

FLORIDA STATE DENTAL SOCIETY

The Florida State Dental Society will hold its thirty-eighth annual meeting June 14, 15, 16, 17, 1921, in Gainesville.

H. B. PATTISHALL, *Secretary*
332 St. James Bldg., Jacksonville, Fla.

VIRGINIA STATE DENTAL ASSOCIATION

The fifty-second annual meeting of the Virginia State Dental Association will be held at the Hotel Jefferson, Richmond, Virginia, October 11, 12, 13, and 14, 1921. A cordial invitation is extended to members of recognized dental societies.

HARRY BEAR, *Secretary*
410 Professional Bldg., Richmond, Va.

NORTH DAKOTA STATE DENTAL ASSOCIATION

The North Dakota State Dental Association will hold its annual meeting in Minot, North Dakota, May 19 and 20, and immediately following, May 21-28, the North Dakota Dental Postgraduate Association will convene. The clinicians for both meetings are Dr. Edward T. Tinker, of Minneapolis, Minnesota, on "Crown and Bridge-Work on Vital Teeth," and Dr. F. E. Roach, of Chicago, on "Partial Denture Construction."

All Association members of any state are urgently requested to come.

SOLON CRUM, *Secretary*
Fargo, N. D.

PROGRAM OF THE NORTHERN OHIO DENTAL ASSOCIATION

The meeting of the Northern Ohio Dental Association will be held in Cleveland June 6, 7, 8. The program is as follows: "Full Denture Construction," (a post-graduate course), Dr. Dayton Dunbar Campbell; "Alveolar Process Resection," Dr. Carl D. Lucas; "Partial Restorations," Dr. Norman B. Nesbett; "Root-Canal Problem of Today," Dr. Edouard M. Hall; "Oral Diagnosis," Dr. Chalmers J. Lyons. Demonstrative clinic courses will be offered free and will include the practical subjects of the day.

J. V. GENTILLY, *Chairman*
809 Schofield Bldg., Cleveland, Ohio

BOARD OF DENTAL EXAMINERS STATE OF WYOMING

The next meeting of the Board of Dental Examiners will be held at Cheyenne, Wyoming, June 28-July 2. An examination is required of all applicants and only holders of diplomas from reputable dental colleges are eligible to such examination. The Board does not interchange with other states, nor issue any temporary permits. No dentist can begin the practice of his profession in this state without first making application for an examination to the Secretary of the Board, and at the same time paying the examination fee of $25.00 and submitting his diploma for inspection. The written examination consists of anatomy, physiology, histology and bacteriology, chemistry and metallurgy, oral surgery, anesthetics, operative and prosthetic dentistry, materia medica and therapeutics, prophylactics and orthodontia.

PETER APPEL, JR., *Secretary*
P. O. Box 643, Cheyenne, Wyo.

PENNSYLVANIA BOARD OF DENTAL EXAMINERS

The next regular examination of the Pennsylvania Board of Dental Examiners will be held in Philadelphia and Pittsburgh, Wednesday, Thursday, Friday, and Saturday, June 22, 23, 24, and 25. The theoretical examinations will be held in Musical Fund Hall, 808 Locust Street, Philadelphia, and the College of Pharmacy Building, Bride and Bluff Streets, Pittsburgh, on Wednesday, Thursday and Friday, June 22, 23 and 24. The practical examinations will be held on Saturday, June 25, in the Evans Dental Institute, Philadelphia, and the University of Pittsburgh, Pittsburgh. Students who present evidence of having passed their second-year examinations in June may appear for the divided examinations on Wednesday and Thursday, June 22 and 23. An examination will be held for the dental hygienists at the same time and place.

Application papers may be secured from the Department of Public Instruction, Harrisburg.

For further information, address

ALEXANDER H. REYNOLDS, *Secretary*
4630 Chester Ave., Philadelphia, Pa.

TENNESSEE BOARD OF DENTAL EXAMINERS

The Tennessee Board of Dental Examiners will hold their next meeting June 14, 1921, at 9:30 A. M. at the Vanderbilt Dental Department, Nashville, Tennessee, for the purpose of examining applicants who wish to secure license to practice dentistry in the state of Tennessee. Secure application blanks from

F. W. MEACHAM, *Secretary-Treasurer*
Hamilton National Bank Building,
Chattanooga, Tenn.

NATIONAL ASSOCIATION OF DENTAL EXAMINERS

The annual meeting of the National Association of Dental Examiners will be held in Milwaukee, Wisconsin, August 15 and 16, at the Hotel Pfister. Members are urged to make their reservations early.

E. A. CHAREONNEL,
Chairman Publicity Committee
Providence, R. I

TEXAS STATE BOARD OF DENTAL EXAMINERS

The Texas State Board of Dental Examiners will hold its next examination in Dallas, Texas, at the Baylor University College of Dentistry, 1420 Hall Street, beginning Monday, June 20, 1921, and continuing thru June 24. The written examinations shall be in the English language in the following subjects: Operative Dentistry, Prosthetic Dentistry, Chemistry, Histology, Pathology and Bacteriology, Anatomy, Orthodontia, Materia Medica, Therapeutics, Oral Surgery, Anesthesia and Physiology.

The practical examination shall consist of three separate operative cases and three prosthetic cases.

Each applicant must furnish his own patients, also all materials and instruments. A chair will be provided.

One gold foil filling, one amalgam filling and a treatment such as extirpation of pulp, extraction of tooth, cleaning teeth will be required.

The Board at its discretion may change these requirements and substitute others.

Practical Prosthetic: Models for a full upper and lower denture must be furnished by the applicant, together with an anatomical articulator and mounted under the observation of the examiner, and the work continued to the point of readiness for investing.

One Richmond crown and one gold shell crown shall be constructed on a natural root fitted into a plaster model, root prepared and crowns constructed under the observation of the examiner.

Separate models mounted on an articulator are required for these two cases.

Each applicant must exhibit a diploma from a reputable dental college and two letters of recommendation for satisfactory evidence of his or her good moral character, or satisfactory evidence that he or she has been regularly engaged in the legal practice of dentistry in any state in the United States for a period of three years next preceding application, shall be entitled to an examination without the presentation of a diploma.

A college shall be considered reputable whose entrance requirements and courses of instructions are as high as those adopted by the better class of dental colleges of the United States.

A general average of 80 per cent is required before an applicant is eligible for a license.

The examination fee is $25.00 and must accompany all applications.

The Texas Dental Law does not provide for the issuance of a temporary license nor reciprocity with any other state.

Written work will be conducted at the Bryan High School Monday and Tuesday. Practical work at Dental College Wednesday and Thursday.

Applications should be in the hands of the Secretary at least five days before the examination.

HARRISON B. CAVE, *Secretary*
Wilson Bldg., Dallas, Tex.

DISTRICT OF COLUMBIA BOARD OF DENTAL EXAMINERS

The Board will hold its next meeting June 20-24, 1921, at Georgetown University, Dental Department, 920 H St., N. W.

The theoretical examination will consist of Oral Surgery and Physiology (Dr. Barnhard); Bacteriology and Histology (Dr. Dolmage); Prosthetic Dentistry and Orthodontia (Dr. Hawley); Operative Dentistry, Pathology, Materia Medica and Therapeutics (Dr. Cobey), and Anatomy and Chemistry (Dr. Simkins). The first two days will be devoted to theoretical examination, the third to practical work in the infirmary and the fourth to prosthetic work in the laboratory.

Each applicant will submit to the Secretary on the first evening of the examination, models of full upper and lower edentulous jaws, attached to an anatomical articulator; also models of full upper and lower teeth for crown and bridge-work with natural roots in position, anatomically articulated.

The following operative work must be completed: One contoured gold filling, reasonably difficult cavity. One cavity for gold inlay prepared, and wax impression made. One compound amalgam filling. The Board cannot furnish patients, or accept excuses for the applicant not having procured them.

The following prosthetic work must be completed: Full upper and lower set of teeth set up anatomically. Applicant will not be required to vulcanize plates. One porcelain-faced crown. One gold crown, carved cusps, swaged or cast. Applicants will furnish all instruments and materials. Writing pads for all examinations will be supplied by the Board, for which a charge of 25 cents will be made. This should be sent to the Secretary with the application.

No application will be considered unless ac-

companied by the examination fee and an unmounted photograph of the candidate. The examination fee will not be returned to the candidate, but in case he fails to appear he will be granted another opportunity without further fee at only the *next* meeting of the Board. Each applicant must report to the Secretary on the first evening and receive a card on which is his examination number, and thruout the examination he will be known by this number. The laws of the District of Columbia do not permit the granting of a temporary license. Fee for the examination, $10.00, and $1.00 for the certificate if granted.

WILLIAM H. BARNHARD, *Secretary*
1225 New York Ave., N. W.,
Washington, D. C.

WEST VIRGINIA STATE BOARD OF DENTAL EXAMINERS

The next meeting of the West Virginia State Board of Dental Examiners will be held in Charleston, West Virginia, June 28, 29, and 30, 1921, beginning on Tuesday morning at nine o'clock. For further information and application blanks address

R. MASON HITE, *Secretary*
Mannington, W. Va.

VIRGINIA STATE BOARD OF DENTAL EXAMINERS

The next regular annual meeting of the Virginia State Board of Dental Examiners will he held in Richmond, Virginia, June 14, at 9:00 A. M.

For further particulars, address

J. P. STIFF, *Secretary*
Fredericksburg, Va.

SOUTH CAROLINA STATE BOARD OF DENTAL EXAMINERS

The annual meeting of the South Carolina State Board of Dental Examiners will be held at Greenville, South Carolina, at the Park School, beginning at nine o'clock Monday morning, June 13, 1921. Application blanks and further information may be obtained by addressing

R. L. SPENCER, *Secretary*
Bennettsville, S. C.

OKLAHOMA STATE BOARD OF DENTAL EXAMINERS

The Oklahoma State Board will examine applicants for license, June 6 to 11, inclusive, at the State Capitol Building, Oklahoma City.

L. M. DOSS, *Secretary-Treasurer*
245 American National Bank Bldg.,
Oklahoma City, Okla.

SOUTHWESTERN SOCIETY OF ORTHODONTISTS

The Southwestern Society of Orthodontists was organized in Dallas, Texas, March 7, 1921, and for six days thereafter the members enjoyed a postgraduate course under the direction of Dr. A. H. Ketcham, of Denver, Colorado. The organization of this society fills a long-felt want among the orthodontists of the Southwest. Some twenty-five orthodontists are located in the states covered by this organization, and the future looks very bright, indeed, for a prosperous society. The next annual meeting will be held in Oklahoma City, Oklahoma. The officers elected for 1921 are as follows: Dr. T. O. German, San Antonio, Texas, president; Dr. W. E. Flesher, Oklahoma City, Oklahoma, president-elect; Dr. P. G. Spencer, Waco, Texas, secretary-treasurer; Drs. T. W. Sorrels, O. E. Busby, and T. G. Duckworth, compose the Board of Censors.

DENTAL VETERANS OF THE WORLD WAR

In April, 1920, the service men who were attending the Michigan State Dental Society meeting organized themselves as the Dental Veterans of the World War. The purposes of the association are to strengthen the ties of friendship formed in the service and to better prepare the dental profession for possible war. Graduate dentists in ethical practice who were in active service in any capacity in the World War in the United States Army, Navy, or Marine Corps, or with any welfare organization are eligible to membership. Arrangements are being made to hold the national meeting in Milwaukee at the time of the National Dental Association meeting.

BION R. EAST, *President*, Detroit, Mich.
HARRY L. HOSMER, *Secretary-Treasurer*
Detroit, Mich.

EXAMINATION FOR NAVAL DENTAL CORPS

An examination was held in Washington on April 11 of candidates for appointment in the permanent dental corps of the Navy. This examination is open to candidates from civil life whose applications have been approved.

The bureau of medicine and surgery expects to conduct another examination of dentists about June 27, which will also be held in Washington. There are now 24 vacancies in the naval dental corps. Successful candidates will be commissioned in the rank of lieutenant (junior grade), and they are promoted with their running mate in the regular medical corps.—*Army and Navy Register*, April 2, 1921.

ARKANSAS STATE BOARD OF DENTAL EXAMINERS

The Arkansas State Board of Dental Examiners will hold the next regular examination at Hotel Marion, Little Rock, Arkansas, June 27, 28, and 29. All applicants must take the examination.

For blanks and rules governing examination address

H. J. GREEN, *Secretary*
Paragould, Ark.

DENTAL ALUMNI SOCIETY, UNIVERSITY OF PENNSYLVANIA

The forty-first meeting of the Dental Alumni Society, University of Pennsylvania, will be held in the Thomas W. Evans Museum and Dental Institute, Fortieth and Spruce Streets, Philadelphia, Friday, June 10, 1921, 9:30 A. M. At this meeting, the War Memorial Tablet, dedicated to the nineteen members of the society who made the supreme sacrifice in the World War, will be unveiled with appropriate exercises. At 2:00 P. M., in the Evans Institute, there will be a series of clinics, which will cover eight phases of dentistry. At 6:30 P. M., the annual banquet will be held in the Hotel Adelphia; subscription fee, $3.50. Send remittance to Dr. William H. Hough, Jr., Chairman, 5729 Baltimore Avenue, Philadelphia. Tables will be reserved for classes holding reunions: class of 1896, Dr. Nathan P. Stauffer, Chairman, 1819 Walnut Street, Philadelphia; class of 1901, Dr. Frank A. Fox, Chairman, 1307 N. Broad Street, Philadelphia; class of 1906, Dr. James R. Mallen, Chairman, Flanders Building, Philadelphia; class of 1911, Dr. William Z. Hill, Chairman, 394 Riverway, Boston, Massachusetts; class of 1916, Dr. Paul B. Camp, Chairman, Chaeakein Bldg., Jamestown, N. Y.

For further information, address

Z. T. JACKAWAY, *Secretary-Treasurer*
1506 E. Susquehanna Ave., Philadelphia, Pa.

RESERVE OFFICERS' TRAINING CORPS CAMPS FOR THE YEAR 1921

The following is from a list of the reserve officers' training corps camps for the year 1921, to be conducted by the corps area commanders, giving camps by arm of the service, location of camp, area from which attendance is drawn and date of opening of camp:

Medical Department—Carlisle Barracks, Pa., selected members of medical, dental and veterinary units thruout the United States; date of opening, June 6, 1921.—*Army and Navy Register,* April 23, 1921.

DENTAL CORPS

Colonel John H. Hess from duty as assistant to corps surgeon 6th corps area, Fort Sheridan, Ill., to San Francisco and about July 5 to Philippine Department for duty as assistant to department surgeon.

Lieutenant Colonel Raymond E. Ingalls from duties in Philippine Department, effective upon completion of present tour of foreign service, to duty at Fort Snelling, Minn.—*Army and Navy Register,* April 2, 1921.

Captain James L. Olsen from duties at Camp Meade, Md., to Edgewood, Md., Arsenal for duty.

The following from duties at Hoboken, N. J., to camps specified for duty: First Lieutenants Arne Sorum, Camp Jackson, S. C.; Charles E. Callery, Camp Meade, Md.—*Army and Navy Register,* April 9, 1921.

Captain Cecil R. Hays, upon arrival in United States, to Camp Benning, Ga., for duty.—*Army and Navy Register,* April 16, 1921.

Major Brantley I. Newsom from duty at Walter Reed General Hospital, D. C., to Camp Jackson, S. C., for duty.

First Lieutenant Glenn D. Lacey from duty at Hoboken, N. J., to Walter Reed General Hospital, D. C., for duty.

Major Albert S. Cumming, dental corps, having been found by an Army retiring board incapacitated for active service on account of disability incident thereto, has been retired from active service.—*Army and Navy Register,* April 23, 1921.